ONTARIO PARKS

Balsam Lake

Vegetation Stewardship Plan

Ontario

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Printed in Ontario, Canada

Cover Photo: Michael Green

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Recommended Citation:
Korol, J.B. 2006. Balsam Lake Vegetation Stewardship Plan. A report prepared for the Ontario Parks Central Zone office, Huntsville.

MNR# 51989
(25 P.R., 060419)
ISBN 0-7794-9319-2

106-07198/

APPROVAL STATEMENT

I am pleased to provide approval for the **Balsam Lake Vegetation Stewardship Plan**. This plan has been developed to meet the commitment of the Balsam Lake Provincial Park Management Plan (1985) to prepare a vegetation management plan for the park. It also has been developed in accordance with A Class Environmental Assessment for Provincial Parks and Conservation Reserves (2005). This document recommends specific management techniques and provides guidelines for the vegetation issues facing park managers.

The plan will be reviewed periodically to address changing issues or conditions and advances in vegetation stewardship practices.

I extend my sincere thanks to all those who participated in the public consultation process. All comments received were carefully considered during the preparation of this document.

Yours truly,

Brian Pfrimmer, Zone Manager
Central Zone, Ontario Parks

April 18, 2006.
Date

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1.0 INTRODUCTION

1.1 Location and Site Description

Balsam Lake Provincial Park is located 6 km southwest of Coboconk in the City of Kawartha Lakes (Figure 1). Its boundary extends from the western shore of North Bay (on Balsam Lake) to Hwy. 48. This 449 ha recreation class park was regulated in 1968 and hosted 178,432 visitors in 2005 (Ontario Parks 2006). Activities include swimming, boating, fishing, camping, picnicking, wildlife viewing, hiking and cross-country skiing. The campgrounds and most recreational activities occur in the eastern third of the park.

The park is in Ecodistrict 6E-9, which was described by Lindsay (1986) as follows. From Lake Couchiching and the north end of Lake Simcoe on the west to Kingston on the east, Ecodistrict 6E-9 reaches across central and eastern Ontario in a long narrow belt, spanning 250 km and varying in width from 12-34 km. It lies just south of the contact between Precambrian shield and Paleozoic bedrock and north of the Peterborough drumlin field. The Kawartha Lakes, part of the Trent River system, are a major part of the landscape in the western half of the ecodistrict. In the eastern part is a series of lakes that also drain into rivers flowing south into the Bay of Quinte on Lake Ontario. Elevations reach 305 m in the western part of the ecodistrict, but slope gently down to 122 m and lower 76 m on the east.

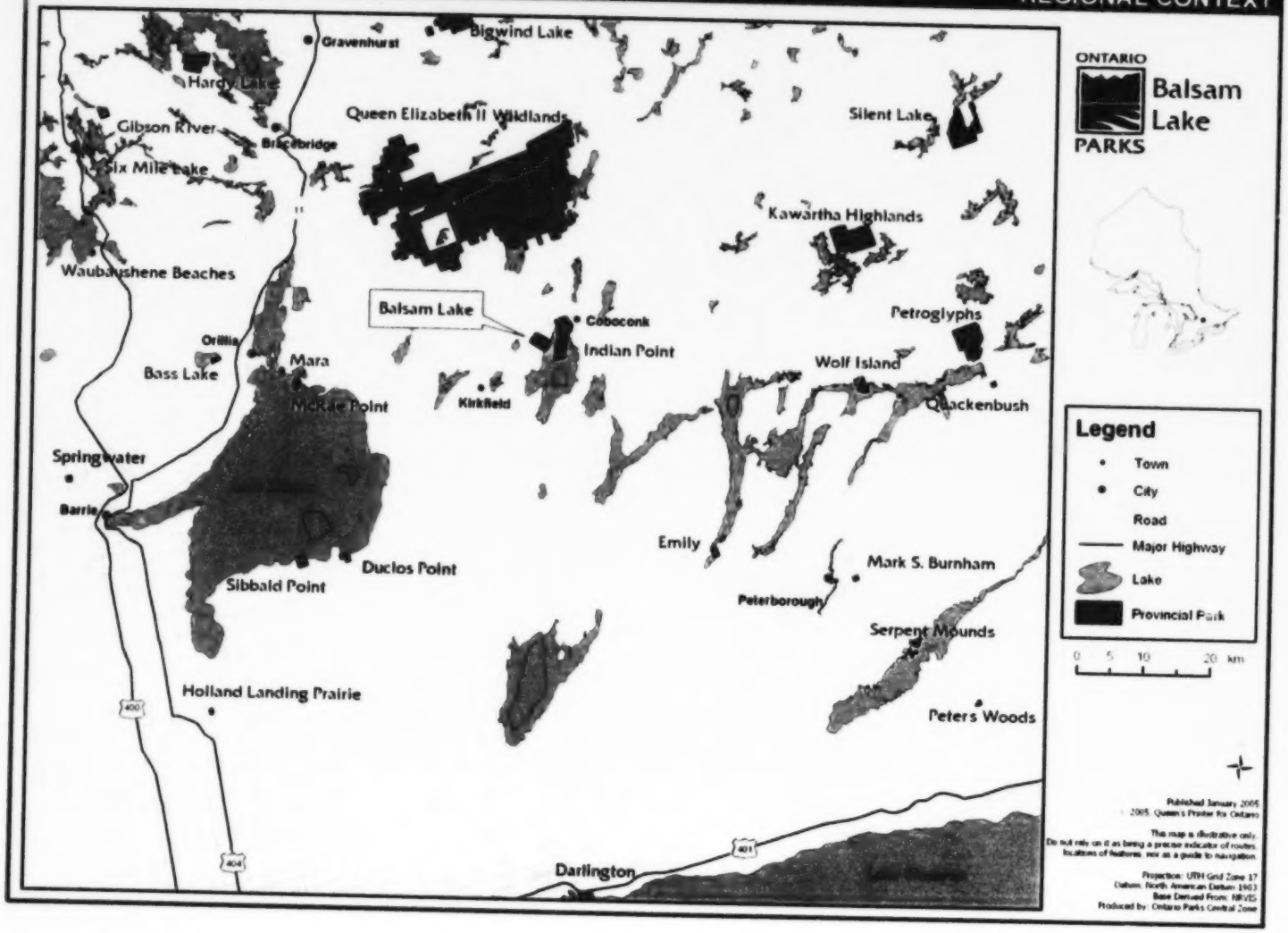
Ecodistrict 6E-9 is one of 16 districts in Ecoregion 6, which is described as a gently undulating to rolling landscape with ice-laid material deeply covering the bedrock over 80% of the area. Local plains of flat, lacustrine deposits and limestone plains shallowly overlain by drift are restricted to several locations. Normal mesic, normal dry and hot dry sites are typically forested with sugar maple-beech-hemlock, sugar maple-oak-ash and oak-ash, respectively. Hemlock, yellow birch, spruce and white cedar occur on wet sites. Hills (1959) described Ecodistrict 6E-9 as an area of high lime, stony loamy till with outcrops of shallowly covered limestone and trains of siliceous and low-base sand.

Two areas of limestone plain with shallow soils dominate this ecodistrict, the Carden plain on the northwest and the Napanee plain on the east. Between is a belt of rough, low, stony moraines, the Dummer moraines. Although limestone plains and till moraines are the dominant landforms in Ecodistrict 6E-9, drumlins, drumlinized till plain, sandplain, kame moraine, clayplain, spillways and eskers also occur.

The following description of the physical features of Balsam Lake Provincial Park was taken from MacDonald (1982). The park occurs on broadly rolling, limy, shallow glacial till deposit, which has experienced considerable post-glacial modification by high lake levels. The terrain is a flat to irregularly rolling plain

FIGURE 1

REGIONAL CONTEXT



with several broadly and irregularly rolling hilly portions in its central, northern and southern corners and along the lakeshore. It is situated in the Carden Plain Physiographic Region (Chapman and Putnam 1966) and has an amplitude from the shoreline to its kame hill crests of over 45 m.

Its bedrock geology is the shallow, moderately rolling to flat Bobcaygeon Formation limestone of Ordovician age (Liberty 1969). Exposures occur as flat pavements locally in the western corner, the eastern quarter, and along the lakeshore, and as incised valleys and shelves displaying rectangular jointing trends in the western and northern quarters.

Its surficial geology is dominated by a moraine till complex which has been strongly resorted and modified by the high water levels of the glacial Lake Algonquin Outlet phases which occupied the present basin of Balsam Lake (Gravenor 1957). Landforms of note are a kame moraine complex which occupies the central third with irregular, 15 m high hills; a low esker ridge system which dissects the park's central portion from north to south; a low drumlin hill in its southeastern corner; a low ancient shore bluff ridge of the glacial Lake Algonquin in its north corner; and a recent lake shore bluff system along the current lakeshore and locally inland. The high water levels of the glacial lake phases have reworked all of these features, rendering the esker and drumlin only barely recognizable from ground level. Associated with the lower esker slopes and eastern limestone plain are broad, wet depressions; as well, there are small linear depressions locally on the kame plain and along the lake backshore. In terms of site types, the substrate classes here include rock, sand, loam and organics.

The soils of the park are predominantly of the rocky shallow, calcareous loams of the Dummer Loam (shallow phase) soil class, presenting generally dry mesic sites over most of its surface area (Gillespie and Richards 1957). The wet depressions of the esker and kame plain support gleysolic soils. Organic soils are recorded only locally from the backshore embayment of the lake margin. Local sandy deposits in the eastern third of the park support a variety of podzol soil profiles in drier sites and gleysols in moist sites. In terms of site types, the moisture regime spans arid to open water sites.

The vegetation of the park was described in detail by MacDonald (1982), which was used as the basis of the following summary. Balsam Lake Provincial Park is located in the north central portion of the Great Lakes – St. Lawrence Region, Huron – Ontario Forest Section (L.1) (Rowe 1972) and the north central portion of the Southern Deciduous Evergreen Forest Region (Maycock 1979). In these areas the vegetation communities display a transitional nature, being mixed to deciduous in composition and sharing both northern and southern species. Normal circum-mesic growth sites support forests composed of Sugar Maple, American Beech, White Birch, Red Oak, White Ash, Eastern White Pine and American Basswood with incidents of White Spruce, Eastern Hemlock, Eastern White Cedar and others. Normal moist sites tend to support deciduous swamp forests of Silver Maple, Red Ash, White Elm, Black Ash, Red Maple and Yellow Birch or coniferous forests of Eastern White Cedar, White Spruce, Balsam Fir, Trembling Aspen and Balsam Fir, with colder moist sites including Black Spruce, Eastern White Cedar, Tamarack and Balsam Fir in the tree canopy and associated concentrations of northerly and boreal understorey species. The warmer dry sites often support open canopied deciduous forests of Red Maple, Red Oak, White Oak, White

Ash, Eastern White Pine and others with associated concentrations of southerly understorey species.

Based on field work done in 1982, MacDonald (1982) reported that the spectrum of sites within the park supported a variety of community patterns of successional and subclimax nature, which is partially representative of the ecodistrict, particularly of the upland calcareous plain, lowland wet sand and rockland plain and lakeshore situations. The 1982 inventory classified communities within the context of their associated landforms and environments. Six such environmental complexes were recognized: kame hills and plain, esker ridge, limestone plain, sand hills and plain, drumlin hill and lake coast. These generally were severely to marginally disturbed and were successional in nature with only a few remnants of the former pristine vegetation still intact as small, discontinuous features.

In 1982, the most widespread communities were the meadows of the interior kame hills and plain, which supported dry site grassland and, occasionally, alvar species. Currently, plantations of White Spruce, Red Pine and Eastern White Pine are established on many of these meadows. MacDonald (1982) mentioned that a local Tamarack plantation was also established but this plantation was not located in 2004, nor are park staff aware of its whereabouts (M. Green, Park Superintendent, pers. comm., 2004). There were also isolated groves of Trembling Aspen, White Ash, White Birch, Balsam Fir and White Spruce. Only locally along the southern slopes of the kame hills were there deciduous, successional forest remnants from previous logging, which have a canopy cover of Sugar Maple, Red Oak, White Ash, American Basswood and Hop Hornbeam. Scattered through this plain were small wetlands, which supported emergent herbaceous, shrub thicket and swamp forest communities.

Towards the lake from this plain is a low esker that supported meadow, scrub and grove communities similar to those of the kame plain. However, it also had additional communities of more extensive mixed forests of Balsam Fir, White Birch, Trembling Aspen and White Spruce, with very local remnants of deciduous forests.

The results of a life science inventory (MacDonald 1982) and reconnaissance level work by the author in 2001 and 2004 show that 410 taxa of vascular plants have been found at Balsam Lake (Appendix 1). Nearly 21% (85 taxa) of the park's vascular plant flora is not native to southern Ontario and 9% (37 taxa) is considered to be invasive.
The following five species of vascular plants occurring at Balsam Lake have alvar affinities[1]: Early Saxifrage (M), Prairie Smoke (E), Balsam Groundsel (M), Prairie Goldenrod (E) and Wild Chess (M).

1.2 Policy Framework

This plan has been developed in accordance with A Class Environmental Assessment for Provincial Parks and Conservation Reserves (MNR 2005) and was screened to a Category B project.

[1] Plants with an affinity for alvars are defined as those with approximately 50% or more of their occurrences in southern Ontario on alvars. Levels of confinement: E = extreme (86-100% of occurrences), H = high (71-85% of occurrences) and M = moderate (50-70% of occurrences).

This vegetation stewardship plan has been developed to fulfill the park resource management policies listed in the Balsam Lake Provincial Park Management Plan (OMNR 1985). The overall goal of the park plan is "to provide a diverse and wide variety of recreation opportunities and to protect significant natural resources." Balsam Lake's heritage appreciation objective is "to provide a range of opportunities for the exploration, interpretation and appreciation of the natural features of the park including the shoreline, vegetation communities and the esker-kame complex. The park's protection objective is "to protect the regionally significant esker-kame complex and several locally significant vegetation communities through zoning that is sensitive to the particular resource management needs of the park's features as well as to the recreational pressures placed on these resources."

The park management plan identified three park zones with the following associated policies:

Development Zone

- to improve the landscape aesthetics and the environmental quality of this zone through landscape plantings, reforestation and drainage improvements

Natural Environment Zone

- to protect the natural features found in this area from detrimental forms of development and recreational use
- to allow appropriate forms of recreational activities to occur
- to monitor these appropriate recreational activities to ensure no future detrimental effect develops affecting the zone's resources
- to take approved management initiatives to improve and enhance the environmental qualities and resources found in this area

Access Zone

- to improve the aesthetic character of the park entrance and access road

Section 4 (Resource Management) of the park management plan calls for the establishment of plant species to minimize the effects of shoreline erosion. Section 4.2 states that:

- All proposed planting projects will be directed by an approved planting and maintenance program as stipulated in a Vegetation Management Plan.
- Non-threatening native forest and vegetation insects and diseases normally will be allowed to develop undisturbed. Control measures, if necessary, will be taken if the aesthetic values inside or outside the park are threatened. Where control is desirable and feasible, it will be directed as narrowly as possible to the specific insect or disease, so as to have minimal effects on other components of the park's environment.

Attitudes and knowledge about natural ecosystems and processes have changed considerably since the park management plan was prepared nearly 20 years ago. To reflect current opinion, more emphasis is placed on ecologic and less on aesthetic park values.

1.3 Goals of Vegetation Stewardship

The goal of vegetation stewardship in Balsam Lake Provincial Park is to ensure the protection and perpetuation of the full diversity of naturally occurring vegetation communities and the processes associated with their development and maintenance. This goal will be achieved through various maintenance and restoration management techniques.

The specific objectives of vegetation stewardship are:

- to conserve, or restore if necessary, viable communities of indigenous plants with an emphasis on provincially significant species and to allow their natural succession
- to restore or enhance natural vegetation features and processes that have been, or are in danger of being, lost or degraded
- to eliminate or reduce the presence of non-native invasive species where feasible
- to provide opportunities for park visitors to learn about and appreciate the park's native vegetation communities and their stewardship in ways that do not threaten their natural values

To meet these objectives more efficiently, it will sometimes be necessary to adopt an active management approach to counter the legacy of human impacts and facilitate the restoration of natural processes.

1.4 Historic Influences on Vegetation Communities

Much of the discussion in this section was based on a 17 September 2004 interview with Mr. Don Wires, who has lived beside the park for all of his 77 years. Most of the land in the area was initially settled between 1850 and 1880 by people who came to the area to log. Among the settlers was Mr. Wires' grandfather who established his homestead in 1866. After the land was cleared and the most valuable trees were removed, local residents turned to ranching as their primary source of income. In 1870 several of the smaller ranches were bought by the Laidlaw brothers. By the end of the 1920's most of the area was converted to pasture, which included planting of forage grasses. In the first half of the 20th century, approximately 100-125 beef cattle were pastured each spring to fall on the future park lands. Although grazing occurred throughout the area, the best forage was found on what is now the Lakeshore Campground. The pond in the northwestern sector of the park retained water throughout the year. The site was grazed until 1954 when it was bought by the provincial government. Currently, cattle graze land adjacent to the north and south park boundaries.

A large and intense fire burned the region in the late 1860's, which significantly reduced the depth of the upper organic soil layer. There have been no major fires in the area in the past 70 years.

All that remains of the pine that were present in the settlement era are the large-diameter stumps that were charred by the fires of the mid-19th century. In the 1920's only scattered Sugar Maple and White Birch remained in the kame hills. The White Spruce plantations north of the main park road were established in 1966. Furrows were plowed along the park's southern boundary in the summer of 1978 and were planted to

White Spruce within a year. Some of the settlers maintained small orchards on their properties but there is little evidence of them today.

In an attempt to control Spruce Budworm (*Choristoneura fumiferana*), the plantations at Balsam Lake have been aerially sprayed with the bacterium *Bacillus thuringiensis* in 2-3 separate years over the past two decades (M. Green, Balsam Lake Provincial Park Superintendent, pers. comm., 2005). In June 2004, the White Spruce plantations were aerially sprayed with Spruce Budworm pheromone. This was part of a larger scale research project that will support the development and registration of pheromone formulations for use in Spruce Budworm management strategies. Details of this study are available from Edward Kettela, Research Program Manager, Natural Resources Canada.

As they have been for the past 20 years, herbicides are used to control Western Poison-ivy along campsite edges, trails and near beach areas.

The variety of natural and semi-natural vegetation cover types which currently occur at Balsam Lake provide useful clues as to the nature of vegetation prior to settlement, despite the considerable disturbance of vegetation here in the past 200 years.

2.0 VEGETATION COMMUNITIES AND SUCCESSIONAL PROCESSES

The vegetation communities of Balsam Lake Provincial Park were described in detail by MacDonald (1982). However, ongoing succession and the level of detail in the 1982 maps make converting the original vegetation units to those used in the current standard (i.e., the Ecological Land Classification (ELC) for Southern Ontario (Lee *et al.* 1998)) very difficult. As a result, the following descriptions of the vegetation communities in the park are based on the author's reconnaissance surveys and may not include all ELC units that are present.

To facilitate vegetation stewardship, communities were separated into broad habitat classes. Within each class, communities are described using terminology found in the ELC ecosite and vegetation types[2], which are the finest levels of classification and are shown in bold below.

2.1 Conifer Plantations

Much of the western half of Balsam Lake Provincial Park was planted to native conifers in 1966 and again in 1978/79. The origin of the seed stock is uncertain, but the White Spruce planted in 1966 and 1978/79 may have come from New Brunswick and Orono, Ontario, respectively (D. Wires, pers. comm., 2004). The **White Spruce – European Larch Coniferous Plantation (CUP3-8)**[3] is one of the study area's most dominant vegetation features, but extensive stands of the **White Pine Coniferous Plantation (CUP3-2)** and the **Red Pine Coniferous Plantation (CUP3-1)** are also present. Most of

[2] **Ecosites** and **vegetation types** are terms used in the ELC. Ecosites are areas with a homogeneous combination of soils and vegetation and are usually mapped at a scale of 1:10,000 or more. Vegetation types are a further subdivision of ecosites, and are based on species composition. The term **community** is used generally to describe vegetation assemblages.

[3] European Larch has not been documented in Balsam Lake Provincial Park and all CUP3-8 plantations are composed only of White Spruce

the conifers in these plantations are generally of uniform height and diameter. Crown closure usually varies from moderate to high, but canopy gaps and more open stands are occasionally present. White Spruce mortality is relatively high due to the perennial infestation of Spruce Budworm (*Choristoneura fumiferana*). The pine plantations appear to be comparatively healthy but there is an apparent paucity of forest health data for the pines. MacDonald (1982) noted that the plantations had "periodic subsequent management for infestations and growth maintenance." Structural and understorey diversity and native hardwood and conifer regeneration are all typically poor. The most common shrubs in the plantations include: Wild Red Raspberry, Western Poison-ivy, Red Elderberry and Hawthorn spp. Typical herbs include Eastern Bracken-fern, Tall Buttercup, Virginia Strawberry, Vetch sp., Yellowish Enchanter's Nightshade, Bitter Nightshade, Common Milkweed, Large-leaf Wood Aster, Mouse-ear Hawkweed, Goldenrod spp., Lesser Burdock, Timothy, Kentucky Bluegrass and Common Helleborine.

2.2 Old Fields

Most of the communities in this category are the **Dry – Moist Old Field Meadow (CUM1-1)**, which are primarily found in esker-kame complex and among the conifer plantations in the western half of the park. These communities are vegetated with a mix of native and non-native, herbaceous vegetation, with scattered shrubs (**Sumac Cultural Thicket (CUT1-1)** and **Poison-ivy Cultural Thicket CUT1-6)**) and native hardwood trees. A few small (<1ha) copses of intolerant hardwoods (**Dry – Fresh Aspen Deciduous Forest (FOD3-1)**) are present in the kame fields and on some plantation-field ecotones. Coniferous trees are established in the meadows, with cover varying from 1-15%. The densest conifer stands are on favourable sites adjacent to existing plantations.

Shrubs such as Hawthorn spp., Western Poison-ivy and Spreading Dogbane were commonly present in the old fields. Typical forbs found include: Eastern Bracken-fern, Tall Buttercup, Long-fruited Anemone, White Sweet-clover, Red Clover, Common Milkweed, Common Viper's-bugloss, Wild Bergamot, English Plantain, Canada, Gray and Early goldenrods, Ciliolate Aster, Yarrow and Doubtful Goat's-beard. Grasses such as Kentucky Bluegrass and Timothy characterize the old fields.

2.3 Native Forest and Wetlands

Most coniferous forest on well drained soils in the park was classified as the **Dry-Fresh White Cedar Coniferous Forest (FOC2-2)**. Conifer stands on imperfectly drained soils included the **Fresh-Moist White Cedar Coniferous Forest (FOC4-1)** and the **Fresh-Moist White Cedar-Balsam Fir Coniferous Forest (FOC4-3)**.

The **Dry-Fresh White Pine-Sugar Maple Mixed Forest (FOM2-2)** was found on well drained soils in the northwest part of the park. **Dry-Fresh White Cedar-White Birch (FOM4-1)**, **Dry-Fresh White Cedar-Aspen (FOM4-2)**, **Dry-Fresh White Birch (FOM5-1)** and **Dry-Fresh Aspen (FOM5-2) Mixed Forest Types** were identified on well drained sites throughout the park. Mixed forests found on moist sites along the western boundary and in the northeastern quarter of the park include the **Fresh-Moist White**

Cedar-Sugar Maple (FOM7-1) and the **Fresh-Moist White Cedar-Hardwood (FOM7-2) Mixed Forest Types**.

Hardwood stands on drier sites, such as along the southeastern border of the kame savannah, have the **Dry-Fresh Sugar Maple-Ironwood (FOD5-4)**, **Dry-Fresh Sugar Maple-Basswood (FOD5-6)**, **Dry-Fresh Sugar Maple-White Ash (FOD5-8)** and the **Dry-Fresh Sugar Maple-White Birch-Aspen (FOD5-10) Deciduous Forest Types**.

Treed wetlands in the study area include a **White Cedar-Conifer Mineral Conifer Swamp (SWC1-2)** and a **Silver Maple Mineral Deciduous Swamp (SWD3-2)**[4] in the southwestern and northwestern corners of the park, respectively. A **Bog Buckbean-Sedge Graminoid Open Fen (FEO1-4)** was identified in the northwest corner of the park. This provincially rare vegetation type is further discussed in Section 6.0. A Tamarack-White Cedar Coniferous Treed Fen (FET1-2) is present in a backshore area near the snack bar.

Wetlands identified at Balsam Lake Provincial Park include **Bluejoint (MAM2-1)**, **Reed Canary Grass (MAM2-2)** and **Narrow-leaved Sedge (MAM2-5) Mineral Meadow Marshes** near Lakeshore Campground. In the northwest a wetland has the **Reed Canary Grass Organic Meadow Marsh (MAM3-2)**, the **Cattail Organic Shallow Marsh (MAS3-1)**, the **Stonewort Submerged Shallow Aquatic (SAS1-3)** and the **Duckweed Floating-leaved Shallow Aquatic (SAF1-3)** vegetation types.

3.0 GENERAL POLICIES

3.1 Conifer Plantations

Ultimately, native conifer plantations should be converted to more ecologically appropriate forest types. The conifers should be thinned to point where their numbers and distribution approximate those of undisturbed climax forests historically found in the ecodistrict. Canopy gaps in the plantations should be naturally regenerated or planted to native tolerant hardwoods so that mixed stands are eventually established. Many of the recommendations in Section 4.0 are based on the concepts described in OMNR (1996).

3.2 Old Fields

The short-term objective for the old fields is to establish an early successional hardwood or mixed forest by encouraging natural regeneration or through a planting program. Successful establishment of trees will depend on factors such as controlling deer and rodent browsing and competition with herbaceous vegetation. Tending seedlings and established trees using manual, mechanical or chemical methods may be required. Details on these methods are available from OMNR (1995). Once a young forest is established, it is expected that herbaceous vegetation will decline due to the increased competition for resources. The long-term objective is to establish a late-successional,

[4] The trees in this swamp were not examined closely enough to determine if they were Silver Maple or the hybrid Freeman's Maple; if the latter, this would have been a Swamp Maple Mineral Deciduous Swamp (SWD3-3)

closed-canopy tolerant hardwood or mixed forest. Achieving the long-term objective will be facilitated by seed rain from established native trees.

Many of the old fields are surrounded by mature native conifer plantations and already have adequate coniferous regeneration present. These conifers currently provide beneficial functions (i.e., native seed rain, site protection, organic inputs, etc.) but their current numbers and distribution should not be allowed to increase. The densest areas of spontaneous conifer regeneration should be thinned to more ecologically appropriate levels.

3.3 Native Forest

Most of the native forest in the study area is in good condition and will require little management effort. Early successional stands should be allowed to develop naturally into later successional stages, which should simply be maintained and monitored.

3.4 Hazardous Trees and Windthrows

Standing dead trees (i.e., snags) provide critical habitat for a wide variety of wildlife. They also pose a safety hazard in areas frequented by park users and near park infrastructure. Traditionally snags have automatically been considered dangerous regardless of the actual risk they may have posed. Standing dead trees in development zones or along trails or roads will be removed if they pose a risk, but otherwise left in place and designated as wildlife trees. Broken or rotted limbs or crowns may be removed, leaving the trunk for wildlife habitat. Eight species of cavity excavating birds, including the provincially rare Red-headed Woodpecker[5], have been found in the study area. They use their cavities as nest and roost sites, which also provide habitat for secondary cavity users (e.g., squirrels, swallows and bluebirds). The presence of cavity dependent species enhances the experience of park users.

Windthrown trees and live branches may be removed where they impede passage along roads or trails, or where the tree falls on day-use or camping areas. On trails, only that portion of the tree across the trail will be removed and all remaining wood will be left in place. In natural areas, fallen trees and limbs, or portions of, will be left in place as long as they do not pose a public safety risk. Among the many functions of downed woody debris are provision of critical habitat for many species of wildlife, nutrient cycling and erosion control.

3.5 Herbicide Use

The Balsam Lake Provincial Park Management Plan does not address herbicide use, but the policy regarding their application in provincial parks has been outlined by Ontario Parks (1993). Alternatives will be used where feasible (e.g., hand-pulling), but use of herbicides often provides the most effective control of exotic or undesirable species. At present, there is no immediate need to reduce or eliminate invasive exotic species in Balsam Lake (Section 5.0) but small, localized applications may be used to control selected exotic species in the park. If a broader application becomes necessary,

[5] This species at risk is designated Vulnerable by the MNR and Special Concern by COSEWIC.

serious consideration of potential environmental impacts versus benefits will be given. Only herbicides which biodegrade quickly, have low or no soil activity and for which environmental impacts have been tested and proven to be minimal will be used.

3.6 Insect Pests

It is widely documented that established defoliating insects such as Spruce Budworm, Gypsy Moth (*Lymantria dispar*) and Forest Tent Caterpillar (*Malacosoma disstria*) pose potentially serious threats to forest vegetation. Given the cyclical nature of their populations, monitoring is vital to the prediction and control of outbreaks.

The potential impacts and ability to control recently discovered wood boring insects such as the Emerald Ash Borer (*Agrilus planipennis*) and Asian Longhorned Beetle (*Anoplophora glabripennis*) are largely unknown. Park staff will need to be educated to recognize the various life stages of these insects and signs of infestations. Park staff will cooperate with MNR and Natural Resources Canada staff in monitoring programs when necessary. Decisions regarding widespread control efforts will be made in cooperation with zone and Ontario Parks' provincial staff and the Canadian Food Inspection Agency.

3.7 White-tailed Deer

Populations of White-tailed Deer that exceed an ecosystem's carrying capacity can seriously decrease forest understorey species richness, diversity and regeneration. The single largest factor affecting the perpetuation of Rondeau Provincial Park's vegetation communities is over-browsing by White-tailed Deer (OMNR 2001). As a result, deer are culled annually from that park. The number of White-tailed Deer currently using Balsam Lake is estimated at 12 in summer an at least 24 during late fall and winter (J. Lytle, Balsam Lake Assistant Park Superintendent, pers. comm. 2004). The Balsam Lake deer population has not changed significantly in the past 30 years (R. Wires, Balsam Lake Maintenance Staff, pers. comm. 2004). The deer undergo local, seasonal migrations.

The relatively low number of deer in the park has probably helped to maintain the overall good condition of the native forest understorey. Eastern White Cedar is heavily browsed in some areas of the park campgrounds, but regeneration levels have offset long-term negative impacts (J. Lytle, pers. comm. 2004). Unless the number of White-tailed Deer increases significantly, no herd management will be needed. However, newly planted species used in old field restoration (see below) may require browsing deterrents to increase the chances of successful regeneration.

3.8 Fire

As mentioned in Section 1.4, fire has historically influenced the development of vegetation communities at Balsam Lake. The current policy of fire suppression has undoubtedly degraded some habitats in the study area and created a significant fire hazard in the White Spruce plantations. Periodic fire favours the maintenance of diverse communities of native species. It also reduces fuel loads, which decreases the likelihood of large or intense fires that are difficult to control. From time to time, it may

be necessary to rejuvenate selected habitats through the use of prescribed burns and active fire management. Low intensity surface fires provide a competitive advantage for oaks, encourage oak regeneration and discourage undesired competition from other species (OMNR 2000). Any burning conducted within the park will follow the Fire Management Policy for Provincial Parks and Conservation Reserves (2004), have an approved prescribed burning plan and be done by trained staff, while ensuring the safety of park visitors and property.

4.0 VEGETATION STEWARDSHIP UNITS AND PRESCRIPTIONS

Natural (e.g., ecotones) and artificial (e.g., firebreaks) boundaries were used to divide the study area into 42 vegetation stewardship units (SUs), which are shown in Figure 2. The structure, composition (tree species codes are defined below) and successional stage of the vegetation in each SU are relatively homogeneous, which will facilitate stewardship activities. The following summarizes the characteristics and management prescriptions for each SU. Prior to implementing individual prescriptions, it will be necessary to conduct detailed field surveys to 1) document the presence of significant and invasive species and, if necessary, mitigate impacts; 2) prepare detailed sylvicultural prescriptions (e.g., marking individual trees, assess blowdown potential); and 3) prepare detailed planting plans for old field SUs (e.g., identify suitable microsites, determine planting density).

Implementing prescriptions in similar SUs should be conducted in a phased approach. This will allow assessment and, if necessary, modification of prescriptions and spreading expenses over a period of years. For example, if SU Sw6 is thinned to decrease its current crown closure by 40%, the impacts of this level of thinning will be monitored and used as a model for subsequent thinning operations in adjacent SUs. Another benefit of the phased approach is age heterogeneity of the vegetation, which will enhance site biodiversity.

The term "encourage" in the recommendations columns in Sections 4.1, 4.2 and 4.3 means to burn or mow competing vegetation within 1 m of a native tree sapling. The trees species listed for planting in individual SUs are in order of preference. In the conifer plantations, merchantable boles can be sold for timber or firewood or chipped for use in the park. Slash should be left in individual piles where each tree was harvested.

It is important to clearly communicate the objectives of this plan to those who will be writing and implementing the management prescriptions. The goals of this plan are to improve Balsam Lake's biodiversity by re-establishing natural forest structure and composition using native species. Maximizing profit from tree harvest and 'improving' forest health are not primary considerations. Tree markers must have a comprehensive knowledge of forest ecology to ensure impacts to stand structural diversity and established native hardwoods are minimized during harvesting operations. The following tree species codes, which are found in the stewardship prescription tables, were taken from the southern Ontario sylvicultural guide (2000).

FIGURE 2

VEGETATION STEWARDSHIP UNITS

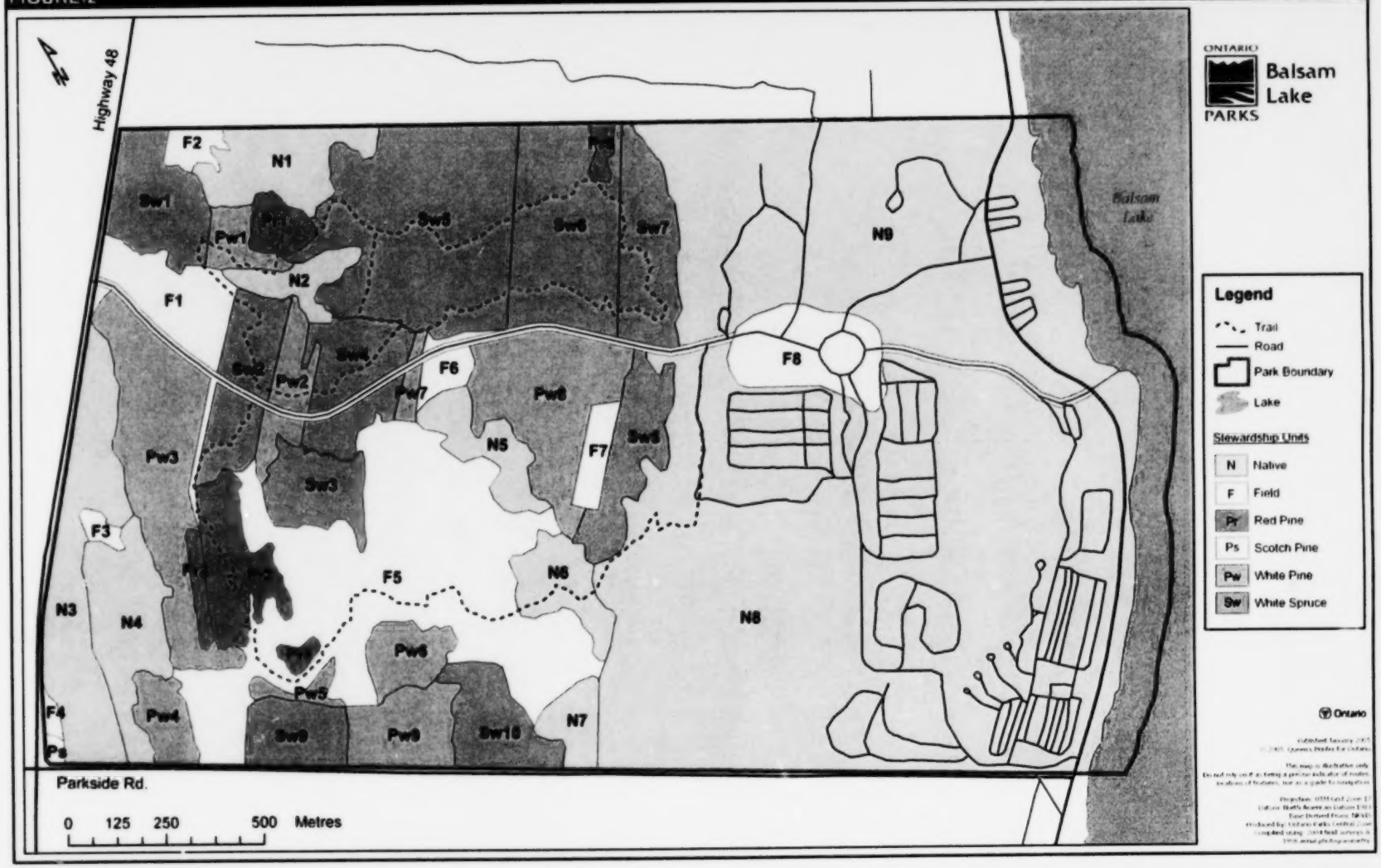


FIGURE 2 **VEGETATION STEWARDSHIP UNITS**

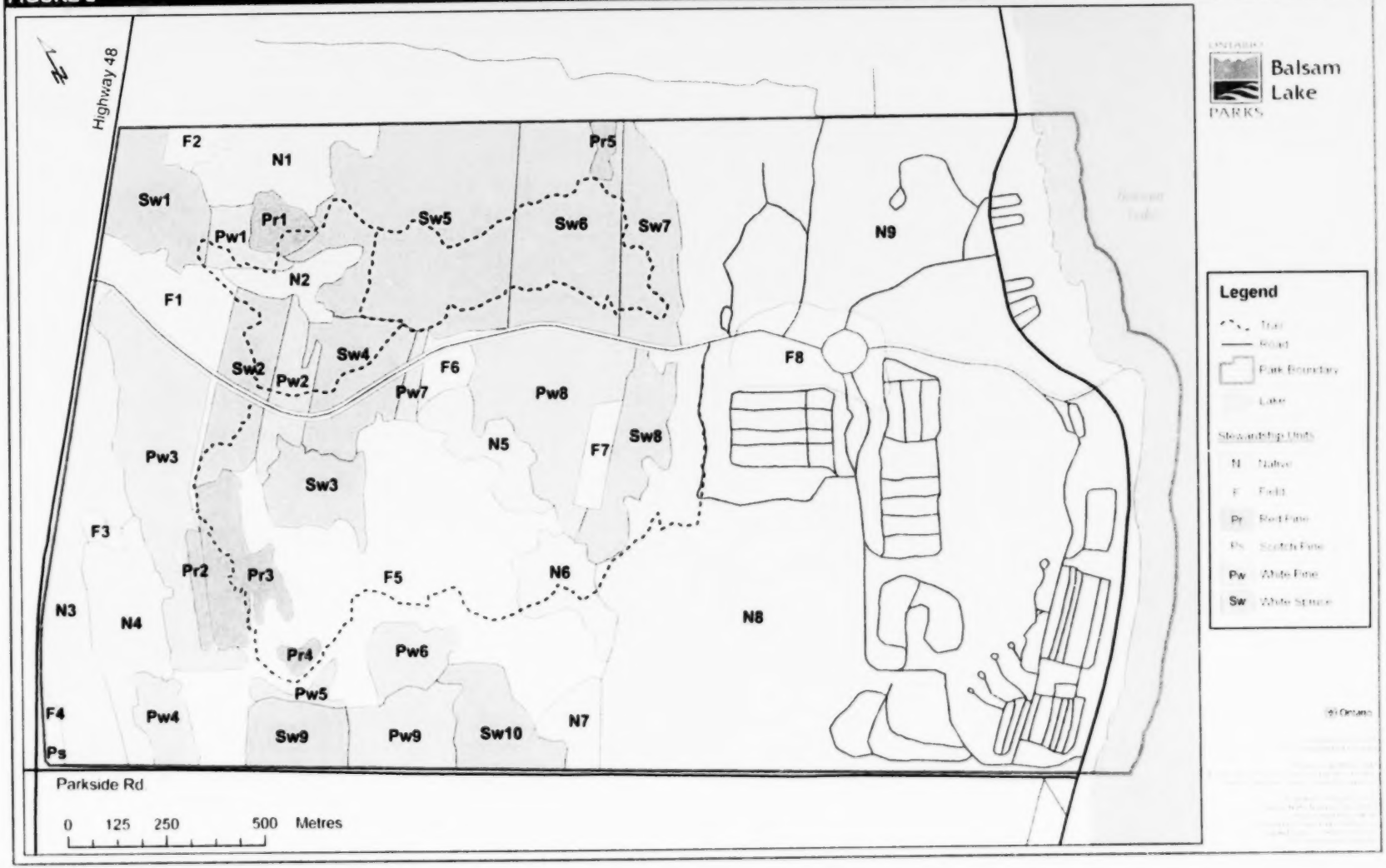


FIGURE 2B

VEGETATION STEWARDSHIP UNITS

FIGURE 2B

VEGETATION STEWARDSHIP UNITS

Tree species codes used in Stewardship Unit perscriptions.

Tree Species Code	Tree Species
Ab	Black Ash
Al	Large-tooth Aspen
At	Trembling Aspen
Aw	White Ash
Bd	Basswood
Be	American Beech
Bf	Balsam Fir
Bn	Butternut
Bw	White Birch
Cb	Black Cherry
Cw	Eastern White Cedar
Ea	White (American) Elm
Id	Hop Hornbeam (Ironwood),
La	Tamarack
Mh	Sugar (Hard) Maple
Mm	Manitoba Maple
Mr	Red (Soft) Maple
Ms	Silver (Soft) Maple
Or	Red Oak
Ow	White Oak
Pb	Balsam Poplar
Pr	Red Pine
Ps	Scotch Pine
Pw	Eastern White Pine
Sw	White Spruce

4.1 Conifer Plantations

SU	Ecosite	Composition	Area (ha)	Past Management	Recommendations
Pr1	CUP3-1	•savannah of mostly open grown Pr to 10 m tall •well developed understorey of native and non-native herbs and scattered hawthorn	2.0	• widely scattered, large diameter stumps present	•initial removal of 30% of Pr stems with subsequent 8-10 year thinning cycles until it composes 5% of stand •if no spontaneous regeneration of native hardwoods within five years, plant Aw, Bd, Mh and Or •encourage colonization and regeneration from Pw1 and N1 seed rain
Pr2	CUP3-1	•mature Pr 15-20 m tall •low to moderate Aw regeneration •Aw to 20 m and 10-15 cm d.b.h. adjacent to southeast end of SU	1.1	• widely scattered, large diameter stumps present • fire break between Pr3 and Pr2	•initial removal of 30% of Pr stems with 8-10 year thinning cycle to follow until 5% of stems remain •release of Aw is expected after Pr is cut •encourage regeneration from Pw3 seed rain •supplemental planting of Or and Mh
Pr3	CUP3-1	•mature Pr to 20 m tall and 20-30 cm d.b.h. •very sparse regenerating Aw to 2 m tall •understorey poor •Aw to 20 m and 10-15 cm d.b.h. adjacent to southwest end of SU	5.9	• widely scattered, large diameter stumps present • estimated that Pr was planted 30 years ago • fire break between Pr3 and Pr2	•initial removal of 30% of Pr stems with 8-10 year thinning cycle until 5% of stems remain •encourage regeneration from Pw3 and Sw2 seed rain •supplemental planting of Or and Mh
Pr4	CUP3-1	•mature Pr 15-20 m tall and 10-25 cm d.b.h. •dense understorey of Aw	0.6	• Pr planted in ??	•immediate removal of 40% of Pr stems •removal of 30% of remaining stems every 8-10 years until 5% of current stems remain •additional hardwood plantings suggested to increase diversity of SU
Pr5	CUP3-1	•mature Pr with good Mh, Ea and Aw regeneration	0.8[6]	• Pr planted in ??	•immediate removal of 30% of Pr stems •removal of 30% of remaining stems every 8-10 years until 5% of current stems remain •encourage native hardwood regeneration
Ps	CUP3-3	• young Ps approximately 8-10 m tall and 10-15 cm d.b.h. with very sparse Aw regeneration • sparse Common Buckthorn	0.3	• field estimate that Ps was planted in 1984	• immediate removal of all Ps • encourage existing Aw regeneration and colonization by native species from N3 • control of Common Buckthorn (Section 5.0)

[6] mapped boundary was difficult to interpret from air photo so area estimate is very approximate

4.1 Conifer Plantations

SU	ELC Units	Composition	Area (ha)	Past Management	Recommendation
Pr1	CUP3-1	• savannah of mostly open grown Pr to 10 m tall • well developed understorey of native and non-native herbs and scattered hawthorn	2.0	• widely scattered, large diameter stumps present	• initial removal of 30% of Pr stems with subsequent 8-10 year thinning cycles until it composes 5% of stand • if no spontaneous regeneration of native hardwoods within five years, plant Aw, Bd, Mh and Or • encourage colonization and regeneration from Pw1 and N1 seed rain
Pr2	CUP3-1	• mature Pr 15-20 m tall • low to moderate Aw regeneration • Aw to 20 m and 10-15 cm d.b.h. adjacent to southeast end of SU	1.1	• widely scattered, large diameter stumps present • fire break between Pr3 and Pr2	• initial removal of 30% of Pr stems with 8-10 year thinning cycle to follow until 5% of stems remain • release of Aw is expected after Pr is cut • encourage regeneration from Pw3 seed rain • supplemental planting of Or and Mh
Pr3	CUP3-1	• mature Pr to 20 m tall and 20-30 cm d.b.h. • very sparse regenerating Aw to 2 m tall • understorey poor • Aw to 20 m and 10-15 cm d.b.h. adjacent to southwest end of SU	5.9	• widely scattered, large diameter stumps present • estimated that Pr was planted 30 years ago • fire break between Pr3 and Pr2	• initial removal of 30% of Pr stems with 8-10 year thinning cycle until 5% of stems remain • encourage regeneration from Pw3 and Sw2 seed rain • supplemental planting of Or and Mh
Pr4	CUP3-1	• mature Pr 15-20 m tall and 10-25 cm d.b.h. • dense understorey of Aw	0.6	• Pr planted in ??	• immediate removal of 40% of Pr stems • removal of 30% of remaining stems every 8-10 years until 5% of current stems remain • additional hardwood plantings suggested to increase diversity of SU
Pr5	CUP3-1	• mature Pr with good Mh, Ea and Aw regeneration	0.8[6]	• Pr planted in ??	• immediate removal of 30% of Pr stems • removal of 30% of remaining stems every 8-10 years until 5% of current stems remain • encourage native hardwood regeneration
Ps	CUP3-3	• young Ps approximately 8-10 m tall and 10-15 cm d.b.h. with very sparse Aw regeneration • sparse Common Buckthorn	0.3	• field estimate that Ps was planted in 1984	• immediate removal of all Ps • encourage existing Aw regeneration and colonization by native species from N3 • control of Common Buckthorn (Section 5.0)

[6] mapped boundary was difficult to interpret from air photo so area estimate is very approximate

SU	Ecosite	Composition	Area (ha)	Rationale/Comments	Recommendation
Pw1	CUP3-2	• mature Pw with very high crown closure; vary sparse mature Id • except for very sparse Mh saplings on northeastern edge of stand native tree regeneration very poor • native and non-native herbs and medium shrubs in understorey very sparse	2.1	• Pw planted in ??	• immediate selective thinning of Pw to decrease current crown closure by 30% • if no spontaneous regeneration of native species occurs within five years plant Be, Mr, Mh, Aw, Bd and Or • removal of 50% of remaining Pw in 8-10 years
Pw2	CUP3-2	• mature Pw with very high crown closure • very sparse hardwood (Pb, At, Aw) regeneration • native and non-native herbs and medium shrubs in understorey very sparse	3.4	• Pw planted in ??	• immediate thinning of stand to decrease current crown closure by 30% • plant tolerant hardwoods if spontaneous regeneration of native species unsatisfactory after five years • removal of 50% of remaining Pw in 8-10 years
Pw3	CUP3-2	• high crown closure of mature Pw with few canopy gaps • very sparse regenerating Cb, Aw, Bp but several large Aw adjacent to southeast end of SU • smaller (i.e., <1 m) Aw and Bp have been browsed • generally poor herb and tall shrub layer	14.0	• very few large diameter stumps present	• immediate thinning of stand to decrease current crown closure by 30% • plant tolerant hardwoods if spontaneous regeneration of native species unsatisfactory after five years • encourage regeneration of native species adjacent to N3 and N4 • removal of 50% of remaining Pw in 8-10 years
Pw4	CUP3-2	• Pw 12-20 m tall and up to 30 cm d.b.h. • regenerating Pw along western boundary of unit • sparse regenerating Pb, Aw and Id	2.8	• scattered large diameter stumps present	• immediate removal of 30% of Pw • encourage existing native hardwood regeneration adjacent to N4 • removal of 50% of remaining Pw in 8-10 years
Pw5	CUP3-2	• Pw 10-15 m tall with 50-60% crown closure • sparse regenerating Aw, At and Pb • single Mm present	1.0	• Pw planted in ??	• removal of 30% of stems where Pw is densest • remove Mm (see Section 5.0) • encourage native hardwood regeneration

SU	ELC Units	Composition	Area (ha)	Past Management	Recommendation
Pw6	CUP3-2	• Pw averaging 15-30 cm d.b.h., 5-15 m tall and 50% crown closure • regenerating Aw, Bd and Pb sparse in interior, but moderate near edges of SU • sparse buckthorn and honeysuckle • single Ow sapling found on Pw9/Pw6 ecotone	3.3	• Pw planted in ?? • lack of thinning has resulted in 'overstocked' stand	• immediate removal of 40% of Pw • determine if buckthorn is non-native; if so, see Section 5.0 • encourage native hardwood regeneration, especially Ow • remove 50% of remaining Pw in 8-10 years
Pw7	CUP3-2	• SU not visited in 2004, but composition assumed to be similar to Pw8	0.9	• Pw planted in ??	• immediate removal of 30% of Pw • encourage established native hardwood regeneration within SU and adjacent to N5 • removal of 50% of remaining Pw in 8-10 years
Pw8	CUP3-2	• Pw 10-15 m tall and 10-30 cm d.b.h. at approximately 2-3 m spacing • canopy averages 90% closure • regenerating Aw and Mh on south edge of SU • understorey very poor with non-native species • very sparse Bd, Pb, Bw and Mh	11.5	• Pw planted in ??	• immediate removal of 30% of Pw • encourage established native hardwood regeneration within SU and adjacent to N5 • removal of 50% of remaining Pw in 8-10 years
Pw9	CUP3-2	• open grown Pw to 10 m tall covering about 25% of SU • single Ow sapling found on Pw9/Pw6 ecotone	5.3	• Pw planted in ??	• encourage established native hardwood regeneration, especially Ow • plant Or, Aw, Bd, Be and Mh in shadier microsites • thin Pw regeneration to maintain cover at 25%
Sw1	CUP3-8	• Sw to 15 m tall with very high crown closure • very sparse, unhealthy Pr • native understorey very poor in shaded areas, but herb and medium shrub layer well developed beneath canopy gaps	6.8	• Sw planted in ??	• selective thinning of Sw to decrease current crown closure by 40% • if no spontaneous regeneration of native trees occurs within five years plant Or, Aw, Bd, Be, Mh and Pw • remove 50% of remaining Sw in 8-10 years • Pr to be unmanaged

SU	ELC Units	Composition	Area (ha)	Past Management	Recommendation
Sw2	CUP3-8	• Sw to 15-20 m tall with variable, but generally high crown closure • sparse mature At and Aw • very sparse Aw seedlings • herb layer well developed beneath canopy gaps	6.2	• Sw planted in ??	• immediate selective thinning of Sw to decrease current crown closure by 40% • encourage existing hardwood regeneration and seed rain from Pw2 and Pw3 • if hardwood regeneration unsatisfactory after five years, plant Or, Aw, Bd, Be and Mh • remove 50% of remaining Sw in 8-10 years
Sw3	CUP3-8	• SU not visited in 2004 but composition assumed to be similar to Sw2	4.7	• Sw planted in ??	• thinning of Sw to decrease current crown closure by 40% • encourage existing hardwood regeneration and seed rain from Pw2 • if hardwood regeneration unsatisfactory after five years, plant Or, Aw, Bd, Be and Mh • remove 50% of remaining Sw in 8-10 years
Sw4	CUP3-8	• SU not visited in 2004 but composition assumed to be similar to Sw5	6.8	• Sw planted in ??	• immediate selective thinning of Sw to decrease current crown closure by 40% • encourage existing hardwood regeneration and seed rain from Pw2, Pw7 and N2 • if hardwood regeneration unsatisfactory after five years, plant Or, Aw, Bd, Be and Mh • remove 50% of remaining Sw in 8-10 years
Sw5	CUP3-8	• primarily Sw • advanced Id regeneration • very sparse At, Aw and Mh • understorey very poorly developed under closed canopies • Wild Red Raspberry occurs under canopy gaps	23.5	• Sw planted 1966	• immediate selective thinning of Sw to decrease current crown closure by 40% • encourage existing hardwood regeneration and seed rain from N1 and N2 • if hardwood regeneration unsatisfactory after five years, plant Or, Aw, Bd, Be and Mh • remove 50% of remaining Sw in 8-10 years
Sw6	CUP3-8	• primarily Sw • advanced Id regeneration • very sparse At, Aw and Mh • understorey very poorly developed under closed canopies • Wild Red Raspberry occurs under canopy gaps	13.5	• Sw planted 1966	• immediate selective thinning of Sw to decrease current crown closure by 40% • if release of native hardwoods unsatisfactory within five years, supplemental planting of Or, Aw, Bd, Be and Mh • encourage germination of seed rain from Pw8 • remove 50% of remaining Sw in 8-10 years

SU	ELC Units	Composition	Area (ha)	Past Management	Recommendation
Sw7	CUP3-8	• dense Sw 10-15 m tall, 10-25 cm d.b.h. with 50-80% crown closure • many dead and broken Sw • 'soft' ecotone boundary with N9 to the east • very sparse mature Ps and Id	7.2	• Sw planted 1966	• immediate selective thinning of Sw to decrease current crown closure by 40% • removal of all Ps • if release of native hardwoods unsatisfactory within five years, supplemental planting of Or, Aw, Bd, Be and Mh • encourage colonization of native species from N9 • remove 50% of remaining Sw in 8-10 years
Sw8	CUP3-8	• Sw near main road is 15-20 m tall, 10-30 cm d.b.h. with a very poor understorey • canopy closure 100% in some areas, but averages 70% • scattered 10-20 m Aw and Id with very sparse Cw and At colonies in interior of SU • very sparse Mh, Pb, Ea and Pw • canopy gaps have native shrubs and herbs	5.9	• tile bed construction began fall 1992 and finished spring 1993	• immediate thinning of Sw to decrease current number of stems by 40% • encourage existing native tree regeneration within SU and adjacent to N6, N8 and Pw8 • planting should not be necessary • remove 50% of remaining Sw in 8-10 years
Sw9	CUP3-8	• Sw to 8 m tall	4.3	• furrows plowed in 1978 and planted to Sw in fall 1978 and spring 1979	• immediate thinning of Sw to decrease current number of stems by 50% • encourage germination of seed rain from Pw5 • planting of Or, Aw, Bd, Be and Mh in shadier microsites • remove 50% of remaining Sw in 8-10 years
Sw10	CUP3-8	• Sw taller and denser than Sw9 but detailed SU data unavailable	5.5	• furrows plowed in 1978 and planted to Sw in fall 1978 and spring 1979	• immediate thinning of Sw to decrease current number of stems by 50% • encourage native tree regeneration adjacent to N7 and Pw6 • consider supplemental planting of Or, Aw, Bd, Be and Mh in shadier microsites • remove 50% of remaining Sw in 8-10 years

4.2 Old Fields

SU	EL C Units	Composition	Area (ha)	Disturbance Level	Recommended
F1	CUM1-1, FOD3-1	• native and non-native herbs • very sparse Sw regeneration • scattered mature E, Bw and Pr, small copse of At	6.1	• old field; stones relocated and piled • widely scattered large, old sawn stumps	• immediate removal of 30% of Sw, 50% of Pr and all Ps • encourage growth of existing native hardwoods • plant Or, Aw and Bd • scarify soil adjacent to Pw1 and Pw3 to enhance germination of seed rain
F2	CUM1-1	• native and non-native herbs • very sparse 2-3 m hawthorn shrubs • very sparse open grown Pw and Mh	1.3	• widely scattered large, old sawn stumps	• encourage growth of existing native trees and colonization from N1 • plant tolerant hardwoods: Aw, Or and Bd
F3	CUM1-1	• native and non-native herbs	0.7	• ?	• encourage colonization of trees from adjacent native forest (N3 and N4)
F4	CUM1-1	• native and non-native herbs and shrubs (e.g., Dwarf Juniper) • <5% cover of mature Ea • single, 15 m, unhealthy Bn found in fall 2004	0.4	• ?	• encourage existing native hardwood regeneration and colonization from N3 • protection and monitoring of health of Bn tree (see Section 6.0)
F5	CUM1-1, CUT1-1, CUT1-6, FOD3-1	• primarily native and non-native herbs • approximately 15% cover of native conifers and very sparse Ps and Ea adjacent to Pw3, Pw4 and Pw5 • approximately 5% cover of mature Ea, At and Bw throughout SU • mature Al stand (<1ha) in southwest part of SU at 668214E, 4943536N	40.0	• widely scattered large, old sawn stumps	• immediate removal of all Ps • encourage existing native hardwood regeneration • cut Pr so cover in SU is <10% • cut Pw and Sw so cover of each in SU is <30% • encourage seeding and colonization of native hardwoods adjacent to Al stand, N5, N6 and N7
F6	CUM1-1	• native and non-native herbs • sparse native hardwood regeneration	1.7	• ?	• encourage seeding and colonization of native hardwoods adjacent to N5 and Pw adjacent to Pw7 and Pw8
F7	CUM1-1	• native and non-native herbs	1.9	• tile bed construction began fall 1992 and finished spring 1993	• continued periodic mowing to prevent perennial hardwood establishment over tile bed
F8	CUM1-1	• native and non-native herbs	7.7	• periodic mowing to prevent perennial hardwood establishment and maintain aesthetics	• reduce area mowed to minimum required for adequate sight lines along roads

4.3 Native Forest

SU	ELC Units	Composition	Area (ha)	Past Management	Recommended
N1	FEO1-4, FOC2-2, FOD5-6, FOM2-2, FOM4-2, FOM5-1, FOM5-2, SWD3-2[7]	• western uplands have sparse mature Mh and Id and abundant Mh saplings • western lowlands have Ms[3] swamps and an open fen dominated by Beaked Sedge, Three-leaved Buckbean, Hemlock Water-parsnip and Blueflag • eastern uplands dominated by Cw with Bf • northern lowlands dominated by Sw, Pw, Al and At, with lesser amounts of Aw, Id and Bf	6.9	• current stand structure in western uplands suggest forests have been logged	• consider thinning Mh saplings in western uplands, but otherwise no management required
N2	MAM3-2, MAS3-1, SAS1-3, SAF1-3	• ephemeral wetland dominated by Reed Canary Grass with very sparse regenerating Mh • shallow water pond with stonewort spp., Lesser Duckweed, Water Smartweed, Hemlock Water-parsnip and Broad-leaved Cattail • upland with mix of tall shrubs (e.g., Red-Osier Dogwood, Shining Willow) and herbs	2.8	• perennial water source used by cattle when site was grazed	• no management required
N3	FOC2-2, FOM4-1, FOM4-2, FOM7-1, FOM7-2, SWC1-2	• north end has dry Cw dominated forest with poor understorey • south end has mixed forest with Cw, Mh, Sw and Bw • western part along Hwy. 48 composed of Cw, Al, At, Sw, Bw and sparse Bd • Cw and Sw mineral swamp with Broad-leaved Cattail on eastern boundary (shared with N4)	13.3	• ?	• no management required
N4	FOC2-2, SWC1-2	• mature, closed-canopy Cw with poor understorey on eastern boundary adjacent to Pw3 • Cw and Sw mineral swamp with Broad-leaved Cattail on western boundary (shared with N3)	8.1	• nothing apparent	• no management required
N5	FOD5-8, FOD5-10	• mature stand dominated by Mh with Bw and Aw	4.3	• ?	• no management required
N6	FOD5-4, FOD5-6, FOD5-8	• multi-layered canopy dominated by Mh with lesser amounts of Aw, Id and sparse Bd • Mh is primarily poles but 25% of stand is mature • dense Mh seedlings in understorey	4.4	• ?	• no management required
N7	FOD	• SU not visited in 2004, but composition described as the same as that in N6 by MacDonald (1982)	2.6	• ?	no management required

[7] The trees in this swamp were not examined closely enough to determine if they were Silver Maple or the hybrid Freeman's Maple; if the latter, this would have been a Swamp Maple Mineral Deciduous Swamp (SWD3-3)

SU	ELC Units	Composition	Area (ha)	Pest Management	Recommended
N8	FOC2-2, FOD5-6, FOM4-2, FOM5-2, MAM2-1, MAM2-2, MAM2-5	• coniferous forest near Campsites 101/102 are dominated by Cw with very sparse Aw and Sw; understorey has scattered Western Poison-ivy , Red Elderberry, Yellowish Enchanter's Nightshade and Common Helleborine • deciduous forest northwest of Mapleview Campground is a mature Mh stand with sparse Bd and Bf and abundant Mh seedlings; understorey species include Leatherwood, Eastern Bracken-fern, Spinulose Wood Fern, Wild Sarsaparilla, Bottlebrush Grass, White-grained Mountain-rice, Common Helleborine • mineral meadow marshes feature Canada Blue-joint, Reed Canary Grass, Slender Sedge and Northern Bugleweed • Sw and Pw south of F8 • mid-successional Sw, Ce stands with At and Pw to the west of Lakeshore Campground • a stand in Hawthorne Valley Campground is dominated by Cw with lesser amounts of Sw and At and sparse Pw and Or • forest adjacent to Sw8 is Cw, Al and At	129.3	• ?	• removal of all Ps, and where highly visible, replace with Pw • control of Common Buckthorn (Section 5.0)
N9	FOC2-2, FOC4-1, FOC4-3, FOM4-2, FOM7-2, FET1-2, CUM1-1	• most of N9 is an early-mid successional native, mixed forest with At, Al, Sw, Cw and scattered Pw but with open areas such as parking lots, recreational beaches and lawns • native vegetation along the beach road is primarily an early successional mixed forest of Sw, Cw, Be Al and At; moist sites also have Bf, Ab, Sw and Bw; mature Pw is scattered throughout • a treed fen has Sb and La with Speckled Alder, Sweet Gale, Swamp Candles, Spotted Joe-pye Weed and Marsh Fern • pure Cw stands along the south western boundary, grading into mixed stands of Cw, At, Id and Ab near the trailer dumping station • Cw, Sw stands with At and sparse Bw along west central boundary with Sw7 • native Sw and At forests north of maintenance yard • Cw, At, Aw and Sw with scattered Pw, Bf and Ea along north boundary • an old field northeast of the traffic circle (670272E, 4943588N) is being colonized by At, Sw and Pw	56.7	• ?	• no management required

5.0 INTRODUCED AND INVASIVE SPECIES

Of the 410 taxa of vascular plants known to occur at Balsam Lake Provincial Park, 85 (21%) are not native to southern Ontario and 37 (9%) are invasive (Appendix 1). The criteria used to categorize invasive species are found in Havinga *et al.* (2000). Invasive species have the potential to move into areas and displace native species, which reduces biodiversity and impacts normal ecological processes. Several invasive species have been intentionally introduced into the park, primarily for their aesthetic or forage values.

For invasive exotic species that have not yet become widespread in the park (e.g., Purple Loosestrife) all individuals should be removed. Complete removal of species that are more widespread or have higher reproductive potential may not be feasible. However, by implementing and maintaining appropriate vegetation stewardship activities (e.g., conversion of plantations and old fields to native forest) habitat changes will likely favour native species.

The following table discusses the management of Category 1 invasive species at Balsam Lake. Category 1 species are those that exclude all other species and dominate sites indefinitely. They are a threat to natural areas wherever they occur because they tend to disperse widely. With assistance from the Central Zone Ecologist, park staff should familiarize themselves with the field identification of the species in the following table.

Status and Recommended Management of Category 1 Invasive Species at Balsam Lake Provincial Park

Species	Current Status	Recommended Management
Black Swallow-wort	first documented in the park in 2004; very rare in plantations	hand removal of all parts of the plant
Canada Thistle	uncommon, but widespread in open areas	effective control often requires two or more of the following: killing established clones, repeated late spring burning, mowing or application of glyphosate; however, increased shade and competition in reforested sites will eventually decrease amount of suitable habitat
Common Buckthorn	uncommon, but widespread in native forest adjacent to beaches and campgrounds	stems should be girdled, preferably in winter, as close to the base of the plant as possible, in a band 2 – 3 cm wide; girdling is more effective than cutting because it prevents resprouting; can also be cut, preferably in June; if cut, nail inverted can to stumps to prevent resprouting
Manitoba Maple	1982 status uncertain; single tree observed in Pw5 in 2004	cut mature trees with repeated, periodic cutting of resprouted stems
Morrow Honeysuckle	abundant and widespread throughout the old fields and kame savannahs	repeated cutting at ground level may result in high mortality, but increased shade and competition in reforested sites will decrease amount of suitable habitat
Purple Loosestrife	first documented in the park in 2004; found only in a ditch along the main road at the Lookout Trailhead; the plant was removed by the author	hand-pull all plants found, ensuring all underground parts are removed; place plants in a container to ensure no seeds are spread and burn container
Tartarian Honeysuckle	uncertain; last observed in 1982	repeated cutting at ground level may result in high mortality, but increased shade and competition in reforested sites will decrease amount of suitable habitat

6.0 SIGNIFICANT FEATURES AND SPECIES AT RISK

The only provincially rare vascular plant species currently known at Balsam Lake is Butternut. This species was identified and mapped for the first time in 2005 (Thompson 2006). Five trees, only two of which were alive, were located in the campground. Butternut is classified as Endangered by both the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Ontario Ministry of Natural Resources. Butternut is ranked S3? [8] (i.e., provincially significant) by the Ontario Natural Heritage Information Centre (NHIC).

The reason this still fairly common tree is at risk is because of recent and widespread mortality, which is primarily due to by the Butternut Canker (*Sirococcus clavigignenti-juglanacearum*). This fungus has been found in about 90% of the Butternuts in Ontario that have been examined. Some trees may be resistant to the disease and current research suggests that the only effective means of conserving the species may be to collect seed from canker-resistant stock for future planting.

The health and seed productivity of Butternut in Balsam Lake needs to be monitored using the methods detailed by Thompson (2006). Monitoring results will be reported to the Butternut Recovery Team and the NHIC. If additional trees are located, a GPS unit will be used to record their locations, the trees will be tagged and an element occurrence record will be filled out and submitted to the NHIC. If seeds are found, they should be collected and planted in suitable sites throughout the park. Since Butternut is not shade tolerant, manual removal of shade trees and competing vegetation is recommended to encourage seedling survival. Detailed information on the ecology, management and conservation of Butternut is available in Ostry *et al.* (1994) or from the Central Zone ecologist.

A **Bog Buckbean-Sedge Graminoid Open Fen (FEO1-4)** was identified at 668977E, 4944592N in the northwest corner of the park. This provincially rare (S3S4) vegetation type should continue to be protected by the 'hand's-off' management recommendation for SU N1. No major alteration of the local hydrologic regime should occur, nor should there be any beaver trapping or dam removal. The site should be checked annually for invasion by non-native species, especially Common Buckthorn or Purple Loosestrife. If found, follow management recommendations listed in Section 5.0.

Significant species and communities should continue to be sought during future vegetation surveys. If any more rare features are found, full documentation should be provided to the Park Superintendent, the Central Zone Ecologist and the NHIC.

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[8] **Rare to uncommon** in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances. Most species with an S3 rank are assigned to the watch list, unless they have a relatively high global rank. The ? indicates that the rank is uncertain.

7.0 RESEARCH AND MONITORING

Research improves our knowledge of, and ability to manage, the park's resources. Monitoring is crucial to evaluating our management successes and failures and identifying effective alternatives. The proposed stewardship activities at Balsam Lake provide significant opportunities for scientific research and monitoring. Because Ontario Parks has limited funding to support these activities, other agencies and institutions should be made aware of the potential prospects at Balsam Lake. Further details can be found in the Central Zone Research Strategy (Korol 2004).

Harvesting and removal or burning of native conifers from plantations has the potential to adversely affect the park ecosystem. Extensive blow down of both desirable and undesirable residual trees is possible if harvest levels exceed critical thresholds. Site disturbance and increased light levels resulting from tree removal and creation of canopy gaps may stimulate weed or undesirable shrub growth (e.g., Wild Red Raspberry). The results of monitoring of the responses of the earliest phases of conifer plantation management should be used to modify subsequent management, if necessary.

Old field management will require monitoring of establishment and depredation of planted seedlings by White-tailed Deer and rodents. If monitoring reveals that spontaneous regeneration of native species under newly opened forest canopies is inadequate, supplemental plantings should be implemented.

8.0 SUMMARY OF KEY MANAGEMENT RECOMMENDATIONS

Through a phased approach, over the next several decades, vegetation stewardship at Balsam Lake Provincial Park should strive to:

- reduce the current number of White Spruce in plantations by 75%
- reduce the current number of Eastern White Pine in plantations by 70%
- eliminate 95% of the Red Pine currently in plantations
- establish a mix of tolerant hardwoods in managed plantations
- remove all Scotch Pine in the park and in frequently visited areas, replace with Eastern White Pine
- allow and encourage old fields to succeed to a forested community with a variety of native tree, shrub and herbaceous species
- locate, monitor and manage all Butternut trees
- find and monitor rare species
- monitor and actively manage non-native, invasive and undesirable plant species

9.0 SUMMARY OF PUBLIC CONSULTATION

As directed by the Class Environmental Assessment for Provincial Parks and Conservation Reserves (MNR 2005), public consultation was an important part of the vegetation stewardship planning process. Once the draft plan was completed stakeholders and local residents were notified by mail. A paid advertisement appeared in the local newspaper and the plan was posted on the Ontario Parks website in February 2006. Paper copies of the plan were sent to those who requested it. Following the release of the notices and draft document there was a 45-day review and comment period. All public comments were carefully considered in the preparation of the final vegetation stewardship plan. The planning process was completed with release of the approved Balsam Lake Vegetation Stewardship plan in April 2006. Copies of the document were distributed to individuals that participated in the planning process. This stewardship plan will be reviewed or amended as required.

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Appendix 1. List of 410 Vascular Plant Taxa Found in Balsam Lake Provincial Park

* = non-native taxa (n=85)
Invasive = invasive taxa; priorities for control range from high (1) to low (4); see Havinga *et al.* (2000)
IM-82 = reconnaissance inventory by MacDonald (1982)
JBK = reconnaissance inventory by B. Korol 2001 and 2004

Family	Scientific Name	Common Name	IM-82	JBK	Invasive
Equisetaceae	*Equisetum arvense*	Field Horsetail	X	X	
Equisetaceae	*Equisetum hyemale*	Rough Horsetail	X		
Equisetaceae	*Equisetum scirpoides*	Dwarf Scouring-rush	X	X	
Equisetaceae	*Equisetum sylvaticum*	Woodland Horsetail	X		
Equisetaceae	*Equisetum variegatum*	Variegated Horsetail	X		
Ophioglossaceae	*Botrychium virginianum*	Rattlesnake Fern	X		
Osmundaceae	*Osmunda cinnamomea*	Cinnamon Fern	X		
Osmundaceae	*Osmunda regalis var. spectabilis*	Royal Fern	X		
Dennstaedtiaceae	*Pteridium aquilinum var. latiusculum*	Eastern Bracken-fern	X	X	
Thelypteridaceae	*Thelypteris palustris var. pubescens*	Marsh Fern	X	X	
Dryopteridaceae	*Athyrium filix-femina var. angustum*	Northern Lady Fern	X		
Dryopteridaceae	*Cystopteris bulbifera*	Bulblet Fern	X		
Dryopteridaceae	*Dryopteris carthusiana*	Spinulose Wood Fern	X	X	
Dryopteridaceae	*Dryopteris cristata*	Crested Wood Fern	X		
Dryopteridaceae	*Dryopteris intermedia*	Evergreen Wood Fern	X		
Dryopteridaceae	*Dryopteris marginalis*	Marginal Wood Fern	X	X	
Dryopteridaceae	*Gymnocarpium dryopteris*	Oak Fern	X		
Dryopteridaceae	*Matteuccia struthiopteris var. pensylvanica*	Ostrich Fern	X		
Dryopteridaceae	*Onoclea sensibilis*	Sensitive Fern	X	X	
Pinaceae	*Abies balsamea*	Balsam Fir	X	X	
Pinaceae	*Larix laricina*	Tamarack	X	X	
Pinaceae	*Picea glauca*	White Spruce	X	X	
Pinaceae	*Picea mariana*	Black Spruce	X	X	
Pinaceae	*Pinus resinosa*	Red Pine	X	X	
Pinaceae	*Pinus strobus*	Eastern White Pine	X	X	
Pinaceae	*Pinus sylvestris**	Scotch Pine*		X	2
Cupressaceae	*Juniperus communis var. depressa*	Dwarf Juniper	X	X	
Cupressaceae	*Thuja occidentalis*	Eastern White Cedar	X	X	
Nymphaeaceae	*Nuphar variegata*	Bulhead Pond-lily	X		
Ranunculaceae	*Actaea pachypoda*	White Baneberry	X		
Ranunculaceae	*Actaea rubra*	Red Baneberry	X	X	
Ranunculaceae	*Anemone acutiloba*	Sharp-lobed Hepatica	X		
Ranunculaceae	*Anemone cylindrica*	Long-fruited Anemone	X	X	

Family	Scientific Name	Common Name			
Ranunculaceae	*Anemone virginiana*	Virginia Anemone	X		
Ranunculaceae	*Aquilegia canadensis*	Wild Columbine	X		
Ranunculaceae	*Ranunculus acris**	Tall Buttercup*	X	X	
Ranunculaceae	*Ranunculus flabellaris*	Yellow Water-crowfoot	X		
Ranunculaceae	*Ranunculus pensylvanicus*	Bristly Buttercup	X		
Ranunculaceae	*Ranunculus recurvatus*	Hooked Buttercup	X		
Ranunculaceae	*Thalictrum pubescens*	Tall Meadow-rue	X		
Ulmaceae	*Ulmus americana*	White Elm	X	X	
Urticaceae	*Boehmeria cylindrica*	False Nettle	X		
Urticaceae	*Pilea pumila*	Dwarf Clearweed	X	?	
Juglandaceae	***Juglans cinerea - S3?*[9]**	**Butternut**		X	
Juglandaceae	*Juglans nigra*	Black Walnut		X	
Myricaceae	*Myrica gale*	Sweet Gale	X		
Fagaceae	*Fagus grandifolia*	American Beech	X		
Fagaceae	*Quercus alba*	White Oak		X	
Fagaceae	*Quercus macrocarpa*	Bur Oak	X		
Fagaceae	*Quercus rubra*	Red Oak	X	X	
Betulaceae	*Alnus incana ssp. rugosa*	Speckled Alder	X	X	
Betulaceae	*Betula alleghaniensis*	Yellow Birch	X		
Betulaceae	*Betula papyrifera*	White Birch	X	X	
Betulaceae	*Corylus cornuta*	Beaked Hazel	X	X	
Betulaceae	*Ostrya virginiana*	Hop Hornbeam	X	X	
Chenopodiaceae	*Chenopodium album(*)*	White Goosefoot	X		
Caryophyllaceae	*Cerastium fontanum**	Common Mouse-ear Chickweed*	X	X	
Caryophyllaceae	*Dianthus armeria**	Deptford Pink*	X	X	
Caryophyllaceae	*Saponaria officinalis**	Bouncing-bet*	X		3
Caryophyllaceae	*Silene vulgaris**	Catchfly*	X	X	
Caryophyllaceae	*Stellaria graminea**	Little Starwort*	X		
Polygonaceae	*Polygonum amphibium var. stipulaceum*	Water Smartweed	X	X	
Polygonaceae	*Polygonum aviculare**	Prostrate Knotweed*	X		
Polygonaceae	*Polygonum convolvulus**	Black Bindweed*	X		
Polygonaceae	*Polygonum lapathifolium*	Pale Smartweed	X		
Polygonaceae	*Polygonum persicaria**	Lady's-thumb*	X		
Polygonaceae	*Polygonum punctatum var. punctatum*	Dotted Smartweed	X		
Polygonaceae	*Rumex acetosella**	Sheep Sorrel*	X		4
Polygonaceae	*Rumex crispus**	Curly-leaf Dock*	X	X	
Clusiaceae	*Hypericum perforatum**	Common St. John's-wort*	X	X	4

[9] The presence of Butternut in Balsam Lake Provincial Park was confirmed by researchers on 9 September 2005.

Family	Scientific Name	Common Name	[illegible]	[illegible]	[illegible]
Clusiaceae	*Triadenum fraseri*	Fraser's St. John's-wort	X		
Tiliaceae	*Tilia americana*	American Basswood	X	X	
Malvaceae	*Malva moschata**	Musk Cheeseweed*	X		4
Droseraceae	*Drosera rotundifolia*	Round-leaved Sundew	X	X	
Violaceae	*Viola blanda*	Sweet White Violet	X		
Violaceae	*Viola canadensis*	Canada Violet	X	?	
Violaceae	*Viola conspersa*	American Bog Violet	X		
Violaceae	*Viola cucullata*	Marsh Blue Violet	X		
Violaceae	*Viola macloskeyi ssp. pallens*	Smooth White Violet	X		
Violaceae	*Viola pubescens var. scabriuscula*	Downy Yellow Violet	X		
Violaceae	*Viola renifolia*	Kidney-leaved Violet	X		
Violaceae	*Viola rostrata*	Long-spurred Violet	X		
Salicaceae	*Populus balsamifera*	Balsam Poplar	X	X	
Salicaceae	*Populus grandidentata*	Large-tooth Aspen	X	X	
Salicaceae	*Populus tremuloides*	Trembling Aspen	X	X	
Salicaceae	*Salix amygdaloides*	Peach-leaved Willow	X		
Salicaceae	*Salix bebbiana*	Long-beaked Willow	X		
Salicaceae	*Salix discolor*	Pussy Willow	X		
Salicaceae	*Salix eriocephala*	Heart-leaved Willow	X	X	
Salicaceae	*Salix fragilis**	Crack Willow*	X		3
Salicaceae	*Salix lucida*	Shining Willow	X		
Salicaceae	*Salix petiolaris*	Slender Willow	X		
Brassicaceae	*Barbarea vulgaris**	Yellow Rocket*	X		3
Brassicaceae	*Erucastrum gallicum**	Common Dogmustard*		X	
Brassicaceae	*Erysimum cheiranthoides**	Wormseed Mustard*	X		
Brassicaceae	*Rorippa palustris ssp. palustris*	Bog Yellow-cress	X		
Pyrolaceae	*Orthilia secunda*	One-sided Wintergreen	X	X	
Pyrolaceae	*Pyrola asarifolia*	Pink Pyrola	X		
Pyrolaceae	*Pyrola chlorantha*	Green-flowered Pyrola	X		
Pyrolaceae	*Pyrola elliptica*	Shinleaf	X		
Monotropaceae	*Monotropa hypopithys*	Pinesap		X	
Monotropaceae	*Monotropa uniflora*	Indian-pipe	X	X	
Primulaceae	*Lysimachia ciliata*	Fringed Loosestrife	X	X	
Primulaceae	*Lysimachia nummularia**	Moneywort*	X	X	2
Primulaceae	*Lysimachia terrestris*	Swamp Loosestrife	X	X	
Primulaceae	*Trientalis borealis*	Star-flower	X		
Grossulariaceae	*Ribes americanum*	Wild Black Currant	X		
Grossulariaceae	*Ribes cynosbati*	Prickly Gooseberry	X	?	
Grossulariaceae	*Ribes glandulosum*	Skunk Currant	X		

Family	Scientific Name	Common Name	[illegible]	[illegible]	[illegible]
Grossulariaceae	*Ribes hirtellum*	Smooth Gooseberry	X		
Grossulariaceae	*Ribes lacustre*	Swamp Black Currant	X		
Grossulariaceae	*Ribes triste*	Wild Red Currant	X		
Saxifragaceae	*Mitella nuda*	Naked Bishop's-cap	X		
Saxifragaceae	*Saxifraga virginiensis*	Early Saxifrage	X		
Saxifragaceae	*Tiarella cordifolia*	False Mitrewort	X		
Rosaceae	*Agrimonia gryposepala*	Tall Hairy Agrimony	X	X	
Rosaceae	*Amelanchier sanguinea*	Roundleaf Juneberry	X		
Rosaceae	*Crataegus chrysocarpa*	Round-leaved Hawthorn	X	?	
Rosaceae	*Fragaria virginiana*	Virginia Strawberry	X	X	
Rosaceae	*Geum aleppicum*	Yellow Avens	X	?	
Rosaceae	*Geum canadense*	White Avens	X		
Rosaceae	*Geum rivale*	Purple Avens	X		
Rosaceae	*Geum triflorum*	Prairie Smoke	X		
Rosaceae	*Malus pumila**	Common Crab-apple*	X	X	
Rosaceae	*Potentilla argentea**	Silvery Cinquefoil*	X		
Rosaceae	*Potentilla norvegica*	Norwegian Cinquefoil	X		
Rosaceae	*Potentilla recta**	Sulphur Cinquefoil*	X	X	
Rosaceae	*Potentilla simplex*	Old-field Cinquefoil	X		
Rosaceae	*Prunus pensylvanica*	Pin Cherry	X	X	
Rosaceae	*Prunus serotina*	Black Cherry	X	X	
Rosaceae	*Prunus virginiana*	Choke Cherry	X		
Rosaceae	*Rosa acicularis*	Prickly Rose	X		
Rosaceae	*Rosa palustris*	Marsh Rose	X		
Rosaceae	*Rubus idaeus ssp. melanolasius*	Wild Red Raspberry	X	X	
Rosaceae	*Rubus occidentalis*	Black Raspberry		X	
Rosaceae	*Rubus odoratus*	Purple Flowering Raspberry	X		
Rosaceae	*Rubus pubescens*	Dwarf Raspberry	X	X	
Rosaceae	*Sorbus americana*	American Mountain-ash	X	?	
Rosaceae	*Sorbus aucuparia**	European Mountain-ash*	X		4
Rosaceae	*Spiraea alba*	Narrow-leaved Meadow-sweet	X		
Rosaceae	*Waldsteinia fragarioides*	Barren Strawberry	X		
Fabaceae	*Amphicarpa bracteata*	Hog Peanut	X	X	
Fabaceae	*Apios americana*	Groundnut	X		
Fabaceae	*Lathyrus palustris*	Marsh Vetchling	X		
Fabaceae	*Lotus corniculatus**	Bird's-foot Trefoil*	X		2
Fabaceae	*Medicago lupulina**	Black Medic*	X	X	4
Fabaceae	*Medicago sativa**	Alfalfa*	X		
Fabaceae	*Melilotus alba**	White Sweet-clover*	X	X	2

Family	Scientific Name	Common Name	[illegible]	[illegible]	Invasive
Fabaceae	*Melilotus officinalis**	Yellow Sweet-clover*	X		2
Fabaceae	*Trifolium aureum**	Yellow Clover*	X	X	
Fabaceae	*Trifolium hybridum**	Alsike Clover*	X		
Fabaceae	*Trifolium pratense**	Red Clover*	X	X	4
Fabaceae	*Trifolium repens**	White Clover*	X	X	4
Fabaceae	*Vicia cracca**	Tufted Vetch*	X	?	2
Fabaceae	*Vicia tetrasperma**	Slender Vetch*	X		3
Elaeagnaceae	*Shepherdia canadensis*	Canada Soapberry	X	X	
Haloragaceae	*Proserpinaca palustris*	Marsh Mermaid-weed	X		
Lythraceae	*Lythrum salicaria**	Purple Loosestrife*		X	1
Thymelaeaceae	*Dirca palustris*	Leatherwood	X	X	
Onagraceae	*Circaea alpina*	Smaller Enchanter's Nightshade	X		
Onagraceae	*Circaea lutetiana*	Yellowish Enchanter's Nightshade	X	X	
Onagraceae	*Epilobium angustifolium*	Fireweed	X	X	
Onagraceae	*Epilobium ciliatum*	Hairy Willow-herb	X		
Onagraceae	*Epilobium palustre*	Marsh Willow-herb	X		
Onagraceae	*Oenothera biennis*	Common Evening-primrose	X	X	
Cornaceae	*Cornus alternifolia*	Alternate-leaved Dogwood	X		
Cornaceae	*Cornus canadensis*	Bunchberry	X		
Cornaceae	*Cornus rugosa*	Round-leaved Dogwood	X	X	
Cornaceae	*Cornus stolonifera*	Red-osier Dogwood	X	X	
Celastraceae	*Celastrus scandens*	Climbing Bittersweet	X		
Aquifoliaceae	*Ilex verticillata*	Winterberry	X		
Euphorbiaceae	*Chamaesyce glyptosperma**	Ring-seeded Spurge*	X		
Euphorbiaceae	*Chamaesyce maculata**	Spotted Spurge*	X		
Rhamnaceae	*Rhamnus alnifolia*	Alder-leaved Buckthorn	X		
Rhamnaceae	*Rhamnus cathartica**	Common Buckthorn*	X	X	1
Vitaceae	*Parthenocissus vitacea*	Inserted Virginia-creeper	X	X	
Vitaceae	*Vitis riparia*	Riverbank Grape	X	X	
Aceraceae	*Acer negundo*	Manitoba Maple	X	X	1
Aceraceae	*Acer rubrum*	Red Maple	X		
Aceraceae	*Acer saccharinum*	Silver Maple	X	X	
Aceraceae	*Acer saccharum ssp. saccharum*	Sugar Maple	X	X	
Aceraceae	*Acer spicatum*	Mountain Maple	X		
Anacardiaceae	*Rhus radicans ssp. rydbergii*	Western Poison-ivy	X	X	
Anacardiaceae	*Rhus typhina*	Staghorn Sumac	X	X	
Oxalidaceae	*Oxalis stricta*	Upright Yellow Wood-sorrel	X	X	
Balsaminaceae	*Impatiens capensis*	Spotted Jewel-weed	X	X	
Araliaceae	*Aralia nudicaulis*	Wild Sarsaparilla	X	X	

Family	Scientific Name	Common Name			
Araliaceae	*Aralia racemosa*	Spikenard	X		
Apiaceae	*Cicuta bulbifera*	Bulb-bearing Water-hemlock	X		
Apiaceae	*Daucus carota**	Wild Carrot*		X	
Apiaceae	*Hydrocotyle americana*	American Marsh-pennywort	X		
Apiaceae	*Osmorhiza claytonii*	Woolly Sweet-cicely	X		
Apiaceae	*Sanicula marilandica*	Black Snakeroot	X		
Apiaceae	*Sium suave*	Hemlock Water-parsnip	X	X	
Gentianaceae	*Gentiana andrewsii*	Closed Gentian	X		
Gentianaceae	*Gentianopsis crinita*	Fringed Gentian	X		
Apocynaceae	*Apocynum androsaemifolium*	Spreading Dogbane	X	X	
Apocynaceae	*Apocynum cannabinum*	Clasping-leaved Dogbane	X		
Asclepiadaceae	*Asclepias incarnata*	Swamp Milkweed	X	X	
Asclepiadaceae	*Asclepias syriaca*	Common Milkweed	X	X	
Asclepiadaceae	*Cynanchum nigrum**	Black Swallow-wort*		X	1
Solanaceae	*Solanum dulcamara**	Bitter Nightshade*	X	X	3
Menyanthaceae	*Menyanthes trifoliata*	Three-leaved Buckbean	X	X	
Hydrophyllaceae	*Hydrophyllum virginianum*	Virginian Water-leaf	X	X	
Boraginaceae	*Cynoglossum officinale**	Hound's-tongue*		X	
Boraginaceae	*Echium vulgare**	Common Viper's-bugloss*	X	X	
Boraginaceae	*Lithospermum officinale**	European Gromwell*	X	X	
Boraginaceae	*Myosotis scorpioides**	True Forget-me-not*	X		4
Boraginaceae	*Symphytum officinale**	Common Comfrey*	X		
Phrymaceae	*Phryma leptostachya*	Lopseed	X		
Verbenaceae	*Verbena hastata*	Blue Vervain	X		
Verbenaceae	*Verbena stricta*	Hoary Vervain		X	
Lamiaceae	*Glechoma hederacea**	Creeping Charlie*	X		4
Lamiaceae	*Lycopus americanus*	American Bugleweed	X		
Lamiaceae	*Lycopus uniflorus*	Northern Bugleweed	X	X	
Lamiaceae	*Mentha arvensis*	Wild Mint	X		
Lamiaceae	*Monarda fistulosa*	Wild Bergamot	X	X	
Lamiaceae	*Nepeta cataria**	Catnip*	X		4
Lamiaceae	*Prunella vulgaris ssp. lanceolata*	Heal-all	X	X	
Lamiaceae	*Scutellaria galericulata*	Hooded Skullcap	X		
Lamiaceae	*Scutellaria lateriflora*	Mad-dog Skullcap	X		
Plantaginaceae	*Plantago lanceolata**	English Plantain*	X	X	
Plantaginaceae	*Plantago major**	Common Plantain*	X		
Plantaginaceae	*Plantago rugelii*	Rugel's Plantain	X		
Oleaceae	*Fraxinus americana*	White Ash	X	X	
Oleaceae	*Fraxinus nigra*	Black Ash	X	X	

Family	Scientific Name	Common Name			
Oleaceae	*Fraxinus pennsylvanica var. pennsylvanica*	Red Ash	X	X	
Scrophulariaceae	*Chelone glabra*	Turtlehead	X		
Scrophulariaceae	*Linaria vulgaris**	Butter-and-eggs*	X		4
Scrophulariaceae	*Mimulus ringens*	Square-stemmed Monkey-flower	X		
Scrophulariaceae	*Penstemon hirsutus*	Hairy Beardtongue	X		
Scrophulariaceae	*Scrophularia marilandica*	Carpenter's Square Figwort	X		
Scrophulariaceae	*Verbascum thapsus**	Common Mullein*	X	X	
Scrophulariaceae	*Veronica anagallis-aquatica**	Water Speedwell*		X	
Scrophulariaceae	*Veronica scutellata*	Marsh Speedwell	X	?	
Scrophulariaceae	*Veronica serpyllifolia ssp. serpyllifolia**	Thyme-leaved Speedwell*	X		
Orobanchaceae	*Epifagus virginiana*	Beech-drops	X		
Campanulaceae	*Campanula aparinoides*	Marsh Bellflower	X		
Campanulaceae	*Campanula rotundifolia*	American Harebell	X		
Campanulaceae	*Lobelia inflata*	Indian-tobacco	X		
Rubiaceae	*Galium asprellum*	Rough Bedstraw	X		
Rubiaceae	*Galium circaezans*	White Wild Licorice	X		
Rubiaceae	*Galium tinctorium*	Stiff Marsh Bedstraw	X	X	
Rubiaceae	*Galium trifidum ssp. trifidum*	Small Bedstraw	X		
Rubiaceae	*Galium triflorum*	Sweet-scented Bedstraw	X		
Rubiaceae	*Galium verum**	Yellow Bedstraw*		X	3
Rubiaceae	*Mitchella repens*	Partridge-berry	X		
Caprifoliaceae	*Diervilla lonicera*	Northern Bush-honeysuckle	X	X	
Caprifoliaceae	*Linnaea borealis ssp. longiflora*	Twinflower	X		
Caprifoliaceae	*Lonicera canadensis*	American Fly Honeysuckle	X		
Caprifoliaceae	*Lonicera dioica*	Glaucous Honeysuckle	X		
Caprifoliaceae	*Lonicera morrowi**	Morrow Honeysuckle*	X	X	1
Caprifoliaceae	*Lonicera tartarica**	Tartarian Honeysuckle*	X		1
Caprifoliaceae	*Sambucus racemosa ssp. pubens*	Red Elderberry	X	X	
Caprifoliaceae	*Symphoricarpos albus*	Snowberry	X		
Caprifoliaceae	*Triosteum aurantiacum*	Coffee Tinker's-weed	X		
Caprifoliaceae	*Viburnum lentago*	Nannyberry	X		
Asteraceae	*Achillea millefolium(*)*	Yarrow	X	X	
Asteraceae	*Ambrosia artemisiifolia*	Annual Ragweed	X	X	
Asteraceae	*Anaphalis margaritacea*	Pearly Everlasting	X	X	
Asteraceae	*Antennaria neglecta*	Field Pussytoes	X		
Asteraceae	*Arctium minus**	Lesser Burdock*	X	X	
Asteraceae	*Bellis perennis**	Lawn Daisy*	X		
Asteraceae	*Bidens cernua*	Nodding Beggar-ticks	X	X	
Asteraceae	*Bidens frondosa*	Devil's Beggar-ticks	X		

Family	Scientific Name	Common Name	M-52	JBK	Invasive
Asteraceae	*Chrysanthemum leucanthemum**	Ox-eye Daisy*	X	X	
Asteraceae	*Cichorium intybus**	Chicory*	X		
Asteraceae	*Cirsium arvense**	Canada Thistle*	X	X	1
Asteraceae	*Cirsium vulgare**	Bull Thistle*	X	X	
Asteraceae	*Conyza canadensis*	Horseweed	X		
Asteraceae	*Doellingeria umbellata var. umbellata*	Flat-top White Aster	X		
Asteraceae	*Erigeron annuus*	Daisy Fleabane	X		
Asteraceae	*Erigeron philadelphicus ssp. philadelphicus*	Philadelphia Fleabane	X		
Asteraceae	*Erigeron strigosus*	Daisy Fleabane	X	X	
Asteraceae	*Eupatorium maculatum ssp. maculatum*	Spotted Joe-pye-weed	X	X	
Asteraceae	*Eupatorium perfoliatum*	Perfoliate Thoroughwort	X	X	
Asteraceae	*Eupatorium rugosum*	White Snakeroot	X		
Asteraceae	*Eurybia macrophylla*	Large-leaf Wood-aster	X	X	
Asteraceae	*Euthamia graminifolia*	Flat-topped Bushy Goldenrod	X	X	
Asteraceae	*Hieracium aurantiacum**	Orange Hawkweed*	X	X	3
Asteraceae	*Hieracium caespitosum**	Field Hawkweed*	X		3
Asteraceae	*Hieracium pilosella**	Mouse-ear Hawkweed*	X		
Asteraceae	*Leontodon autumnalis**	Fall Hawkbit*	X		
Asteraceae	*Matricaria matricarioides**	Pineapple-weed*	X		
Asteraceae	*Packera paupercula*	Balsam Groundsel	X		
Asteraceae	*Petasites frigidus*	Palmate-leaf Sweet-coltsfoot	X		
Asteraceae	*Prenanthes alba*	White Rattlesnake-root	X	X	
Asteraceae	*Rudbeckia laciniata*	Cut-leaved Coneflower	X	X	
Asteraceae	*Solidago caesia*	Blue-stem Goldenrod	X		
Asteraceae	*Solidago canadensis var. canadensis*	Canada Goldenrod	X	?	
Asteraceae	*Solidago hispida*	Hairy Goldenrod	X		
Asteraceae	*Solidago juncea*	Early Goldenrod	X		
Asteraceae	*Solidago nemoralis ssp. nemoralis*	Gray Goldenrod	X		
Asteraceae	*Solidago ptarmicoides*	Prairie Goldenrod	X		
Asteraceae	*Solidago rugosa*	Rough Goldenrod	X		
Asteraceae	*Solidago uliginosa*	Bog Goldenrod	X		
Asteraceae	*Symphyotrichum ciliolatum*	Ciliolate Aster	X	X	
Asteraceae	*Symphyotrichum ericoides var. ericoides*	White Heath Aster	X		
Asteraceae	*Symphyotrichum lanceolatum*	Panicled Aster	X		
Asteraceae	*Symphyotrichum lateriflorum*	Starved Aster	X		
Asteraceae	*Symphyotrichum novae-angliae*	New England Aster	X	X	
Asteraceae	*Symphyotrichum puniceum*	Purple-stemmed Aster	X		
Asteraceae	*Taraxacum officinale**	Common Dandelion*	X	X	
Asteraceae	*Tragopogon dubius**	Doubtful Goat's-beard*	X	X	

Family	Scientific Name	Common Name	IM-82	JBK	Invasive
Asteraceae	*Tussilago farfara**	Coltsfoot*	X	X	4
Alismataceae	*Alisma subcordatum*	Southern Water-plantain	X	X	
Alismataceae	*Sagittaria latifolia*	Broad-leaved Arrowhead	X		
Hydrocharitaceae	*Elodea canadensis*	Common Waterweed	X		
Potamogetonaceae	*Potamogeton sp.*	Pondweed	X		
Najadaceae	*Najas flexilis*	Slender Najas	X		
Araceae	*Calla palustris*	Wild Calla	X		
Lemnaceae	*Lemna minor*	Lesser Duckweed	X	X	
Juncaceae	*Juncus alpinoarticulatus*	Richardson's Rush	X		
Juncaceae	*Juncus articulatus*	Jointed Rush	X		
Juncaceae	*Juncus brevicaudatus*	Short-tailed Rush	X		
Juncaceae	*Juncus bufonius*	Toad Rush	X		
Juncaceae	*Juncus dudleyi*	Dudley's Rush	X		
Cyperaceae	*Carex albursina*	White Bear Sedge	X		
Cyperaceae	*Carex arctata*	Black Sedge	X		
Cyperaceae	*Carex aurea*	Golden-fruited Sedge	X		
Cyperaceae	*Carex communis*	Fibrous-root Sedge	X		
Cyperaceae	*Carex cristatella*	Crested Sedge	X		
Cyperaceae	*Carex deflexa*	Northern Sedge	X		
Cyperaceae	*Carex deweyana*	Short-scale Sedge	X		
Cyperaceae	*Carex diandra*	Lesser Panicled Sedge	X		
Cyperaceae	*Carex disperma*	Soft-leaved Sedge	X		
Cyperaceae	*Carex eburnea*	Ebony Sedge	X		
Cyperaceae	*Carex flava*	Yellow Sedge	X		
Cyperaceae	*Carex gracillima*	Graceful Sedge	X		
Cyperaceae	*Carex granularis*	Meadow Sedge	X		
Cyperaceae	*Carex hitchcockiana*	Hitchcock's Sedge	X		
Cyperaceae	*Carex hystericina*	Porcupine Sedge	X		
Cyperaceae	*Carex interior*	Inland Sedge	X		
Cyperaceae	*Carex intumescens*	Bladder Sedge	X		
Cyperaceae	*Carex lasiocarpa var. americana*	Slender Sedge	X		
Cyperaceae	*Carex leptalea*	Bristle-stalk Sedge	X		
Cyperaceae	*Carex pallescens*	Pale Sedge	X		
Cyperaceae	*Carex pedunculata*	Long-stalked Sedge	X		
Cyperaceae	*Carex pellita*	Woolly Sedge	X		
Cyperaceae	*Carex pensylvanica*	Pennsylvania Sedge	X		
Cyperaceae	*Carex pseudo-cyperus*	Cyperus-like Sedge	X		
Cyperaceae	*Carex retrorsa*	Retrorse Sedge	X	X	
Cyperaceae	*Carex rosea*	Rosy Sedge	X		

Family	Scientific Name	Common Name	IM-82	JBK	Invasive
Cyperaceae	*Carex siccata*	Dry-spike Sedge		X	
Cyperaceae	*Carex sparganioides*	Burreed Sedge	X		
Cyperaceae	*Carex spicata**	Spiked Sedge*	X		
Cyperaceae	*Carex stipata var. stipata*	Awl-fruited Sedge	X		
Cyperaceae	*Carex tenera*	Straw Sedge	X		
Cyperaceae	*Carex utriculata*	Beaked Sedge	X	X	
Cyperaceae	*Carex vesicaria*	Inflated Sedge	X		
Cyperaceae	*Carex vulpinoidea*	Fox Sedge	X		
Cyperaceae	*Eleocharis elliptica*	Elliptic Spike-rush	X		
Cyperaceae	*Eleocharis erythropoda*	Bald Spike-rush	X		
Cyperaceae	*Eleocharis smallii*	Creeping Spike-rush	X		
Cyperaceae	*Schoenoplectus tabernaemontani*	Soft-stem Club-rush	X		
Cyperaceae	*Scirpus atrovirens*	Dark-green Bulrush	X	X	
Cyperaceae	*Scirpus cyperinus*	Cottongrass Bulrush	X	X	
Poaceae	*Agrostis scabra*	Rough Bentgrass	X		
Poaceae	*Agrostis stolonifera*	Spreading Bentgrass	X		
Poaceae	*Brachyelytrum erectum*	Bearded Shorthusk	X		
Poaceae	*Bromus ciliatus*	Fringed Brome	X		
Poaceae	*Bromus inermis*	Awnless Brome	X	X	
Poaceae	*Bromus kalmii*	Wild Chess	X		
Poaceae	*Calamagrostis canadensis*	Canada Blue-joint	X	X	
Poaceae	*Dactylis glomerata**	Orchard Grass*	X	X	3
Poaceae	*Danthonia spicata*	Poverty Oatgrass	X	X	
Poaceae	*Echinochloa crusgalli**	Barnyard Grass*	X		
Poaceae	*Elymus canadensis*	Nodding Wild-rye	X		
Poaceae	*Elymus hystrix*	Bottlebrush Grass	X	X	
Poaceae	*Elymus repens**	Creeping Wild-rye*	X		3
Poaceae	*Festuca pratensis**	Meadow Fescue*	X		
Poaceae	*Festuca rubra*	Red Fescue	X		
Poaceae	*Glyceria borealis*	Northern Mannagrass	X		
Poaceae	*Glyceria striata var. striata*	Fowl Mannagrass	X		
Poaceae	*Leersia oryzoides*	Rice Cutgrass	X	X	
Poaceae	*Lolium perenne**	English Ryegrass*	X		
Poaceae	*Muhlenbergia mexicana*	Mexican Muhly	X		
Poaceae	*Oryzopsis asperifolia*	White-grained Mountain-rice	X	X	
Poaceae	*Panicum acuminatum*	Panic Grass	X		
Poaceae	*Panicum capillare*	Old Witch Panic Grass	X		
Poaceae	*Phalaris arundinacea*	Reed Canary Grass	X	X	5
Poaceae	*Phleum pratense**	Timothy*	X	X	

Family	Scientific Name	Common Name	[illegible]	[illegible]	[illegible]
Poaceae	*Poa annua**	Annual Bluegrass*	X		
Poaceae	*Poa compressa**	Canada Bluegrass*	X		
Poaceae	*Poa palustris*	Fowl Bluegrass	X		
Poaceae	*Poa pratensis*	Kentucky Bluegrass	X	X	
Poaceae	*Poa saltuensis*	Drooping Bluegrass	X		
Poaceae	*Schizachne purpurascens*	False Melic Grass	X		
Poaceae	*Setaria pumila**	Yellow Foxtail*	X	X	4
Poaceae	*Sphenopholis intermedia*	Slender Wedgegrass	X		
Poaceae	*Sporobolus neglectus*	Small Dropseed	X		
Sparganiaceae	*Sparganium emersum*	Greenfruit Bur-reed	X		
Sparganiaceae	*Sparganium natans*	Small Bur-reed	X		
Typhaceae	*Typha angustifolia**	Narrow-leaved Cattail	X	X	
Typhaceae	*Typha latifolia*	Broad-leaved Cattail	X	X	
Liliaceae	*Clintonia borealis*	Bluebead-lily	X		
Liliaceae	*Lilium philadelphicum*	Wood Lily	X		
Liliaceae	*Maianthemum canadense var. canadense*	Wild Lily-of-the-valley	X	X	
Liliaceae	*Maianthemum racemosum*	False Solomon's Seal	X	X	
Liliaceae	*Polygonatum pubescens*	Downy Solomon's-seal	X		
Liliaceae	*Trillium grandiflorum*	White Trillium	X		
Smilacaceae	*Smilax herbacea*	Smooth Herbaceous Greenbrier	X		
Iridaceae	*Iris versicolor*	Blueflag	X	X	
Iridaceae	*Sisyrinchium montanum*	Mountain Blue-eyed-grass	X		
Orchidaceae	*Cypripedium calceolus var. pubescens*	Large Yellow Lady's-slipper	X		
Orchidaceae	*Epipactis helleborine**	Common Helleborine*	X	X	
Orchidaceae	*Liparis loeselii*	Fen Twayblade	X		
Orchidaceae	*Malaxis monophyllos ssp. brachypoda*	White Adder's-mouth	X		
Orchidaceae	*Platanthera aquilonis*	Leafy Northern Green Orchid	X		
Orchidaceae	*Spiranthes cernua*	Nodding Ladies'-tresses	X		
		Totals	**396**	**162**	**37**

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(25 P.R., 05 11 16)
ISBN 0-7794-9319-2 (Print)

Printed on recycled paper